NOVEMBER · 1954
PRICE 35 CENTS

ELECTRICAL CONSTRUCTION AND MAINTENANCE

WITH ELECTRICAL CONTRACTING

New floodlighting system reveals classical architecture of Washington's National Archives building

Page 80

Miami's Progress House demonstrates advanced wiring design for modern electrical living

Page 92

A SPECIAL REPORT ON

Electric Space Heating

How to
- select
- design modern space heating
- apply

equipment including load calculation tables and Code requirements. Page 67

A McGRAW-HILL PUBLICATION | 54TH YEAR

G-E Capacitors at Colson Corporation raise power factor, save $3600 a year

"Power factor has jumped from a low of 84% to over 95% and we're saving $300 a month," reports Arthur Davis, Superintendent at the Colson Corp., Elyria, Ohio.

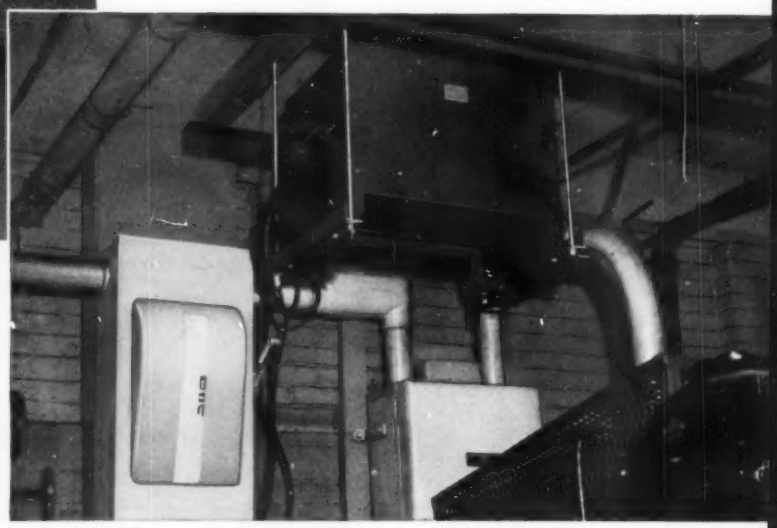
"Except for an occasional check of fuses, we have put them up and forgotten about them," Mr. Davis reports. "We were able to locate all of them on platforms keeping them out of the way and nearer to power lines."

With the assistance of the Elliott Electric Co., 450 kvar of capacitors at 230 volts were installed which released the strain put on transformers during peak production periods and eliminated the necessity of rewiring or the addition of expensive new equipment.

It will pay you to investigate the possibility of a capacitor installation in your plant. If your power factor is below 85% and if there is a power factor or kva-demand clause in your power bill, chances are, you too can make substantial savings in your power bill by installing capacitors. Besides reducing your power bills, capacitors can release extra system capacity and permit your distribution system to carry 20 to 30 percent more load.

For more information about G-E industrial capacitors, contact your nearest G-E Apparatus Sales Office, or write for Bulletin GEA-5632 to Section 441-109, General Electric Company, Schenectady 5, N. Y.

Jack E. Davis, Plant Manager, discusses G-E capacitor installation in wood shop with Art Davis, plant superintendent.



G-E capacitors installed out of the way and near power line in the Truck Shop at Colson Corp., Elyria, Ohio.

Progress Is Our Most Important Product

GENERAL ELECTRIC

Keep cables in top form with United States Rubber Company's Tapes

Reinsulating and splicing with U. S. Tapes restore a cable or wire to its original dielectric strength and efficiency. They are made by United States Rubber Company, the only tape manufacturer to grow its own natural rubber and make its own synthetic rubber and plastics. "U. S." has amassed years of experience, research data and skill in the manufacture of tapes that guarantee *dependability* in *any* one of the tapes in the "U. S." Line.

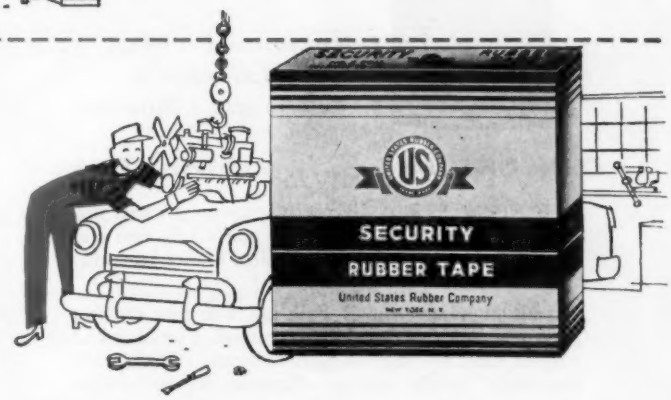
Because the "U. S." Line is complete, you can simplify purchasing by ordering from this *single* line. Order from a selected "U. S." distributor or any of the 27 "U. S." District Sales Offices.

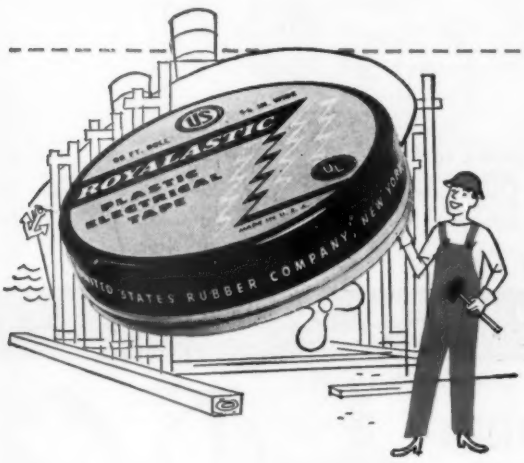
U. S. Security® Friction Tape

For electrical and general purpose jobs. Strong and tacky—it stays on. Does not age or dry out. Unusually high tensile strength for tough assignments. Straight-tearing, non-ravelling. Also in specification grade—U. S. Holdtite®—exceeds A.S.T.M. specifications.

U. S. Security Rubber Tape

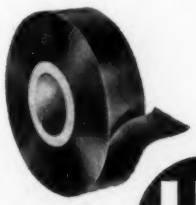
Excellent for all general electrical work. This unvulcanized rubber splicing compound is high in tensile strength, elongation, tackiness, dielectric strength and stretch. Handles easily, fuses without heat. Also in a specification grade—U.S. Holdtite—exceeds A.S.T.M. specifications.





U. S. Royalastic Plastic Tape

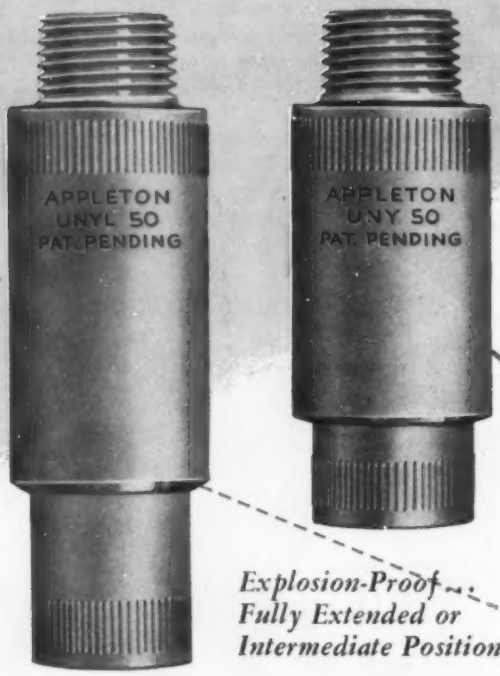
Makes a thin splice, keeps wiring neat and uncluttered. Does the work of both rubber *and* friction tape in many applications. Complete mechanical and electrical protection. High dielectric strength and resistance to abrasion, water, oils, acids, alkalies and corrosive chemicals. Good stretch, tight grip. Approved by Underwriters' Laboratories, Inc.



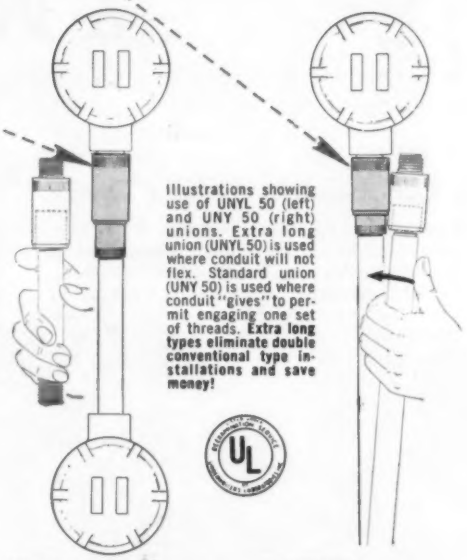
UNITED STATES RUBBER COMPANY

MECHANICAL GOODS DIVISION · ROCKEFELLER CENTER, NEW YORK 20, N. Y.

NEW! Self-Adjusting Explosion-Proof EXPANSION UNIONS by APPLETON



Explosion-Proof — Fully Extended or Intermediate Positions



Illustrations showing use of UNYL 50 (left) and UNY 50 (right) unions. Extra long union (UNYL 50) is used where conduit will not flex. Standard union (UNY 50) is used where conduit "gives" to permit engaging one set of threads. **Extra long types eliminate double conventional type installations and save money!**

EXTRA LONG

UNYL Union showing up to 1-11/32" expansion . . . serves the purpose of two conventional type unions!

STANDARD

UNY Union showing up to 21/32" expansion . . . for installation wherever conventional types were previously used!

Only ONE Unit . . . Two Moving Parts

APPLETON Explosion-Proof Expansion Unions are completely new and different . . . afford an ease and simplicity of installation never before known with this type of explosion-proof equipment!

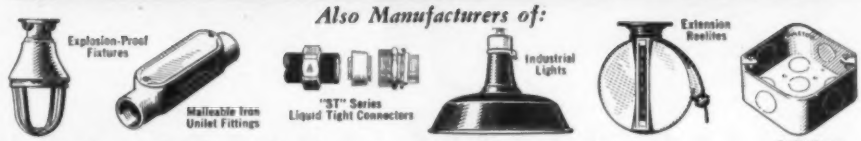
Expansion adjustment is built-in! The *two* moving parts telescope or expand to accommodate usual thread lengths. Only *two* tightening operations . . . each made separately! Smaller external diameters for convenient use in restricted quarters! Precision construction for absolute explosion-proof protection . . . no need to worry about failure to draw surfaces together . . . the union remains completely explosion-proof at all times, regardless of its retracted or extended position! Special design guarantees positive ground at all times!

Get acquainted with the *extra* quality and utility built into APPLETON Explosion-Proof Expansion Unions. Write for complete details.

Sold Exclusively Through Selected Wholesalers

APPLETON ELECTRIC COMPANY
1704 Wellington Avenue • Chicago 13, Illinois

Also Manufacturers of:



Rely on **APPLETON** *... The Standard for Better Wiring*

Published for electrical contractors, industrial electricians, engineers, consultants, inspectors and motor shops. Covering engineering, installation, repair, maintenance and management, in the field of electrical construction and maintenance.

ELECTRICAL CONSTRUCTION AND MAINTENANCE

with which is consolidated Electrical Contracting, The Electrologist and Electrical Record . . . Established 1901

54th Year NOVEMBER • 1954

MORE

NOVEMBER • 1954 *continued*

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ALWAYS

Red at a glance

...in any light

...without twisting

...no matter how dirty

Red conductors in Simplex Control Cables always read red. That's because they're positively identified by white printing on solid black background. They won't change color under different lights the way conductors with colored neoprene coverings do.

Simplex Control Cable conductors don't have to be twisted for identification because color coding is printed on both sides of every conductor at 2½-inch intervals.

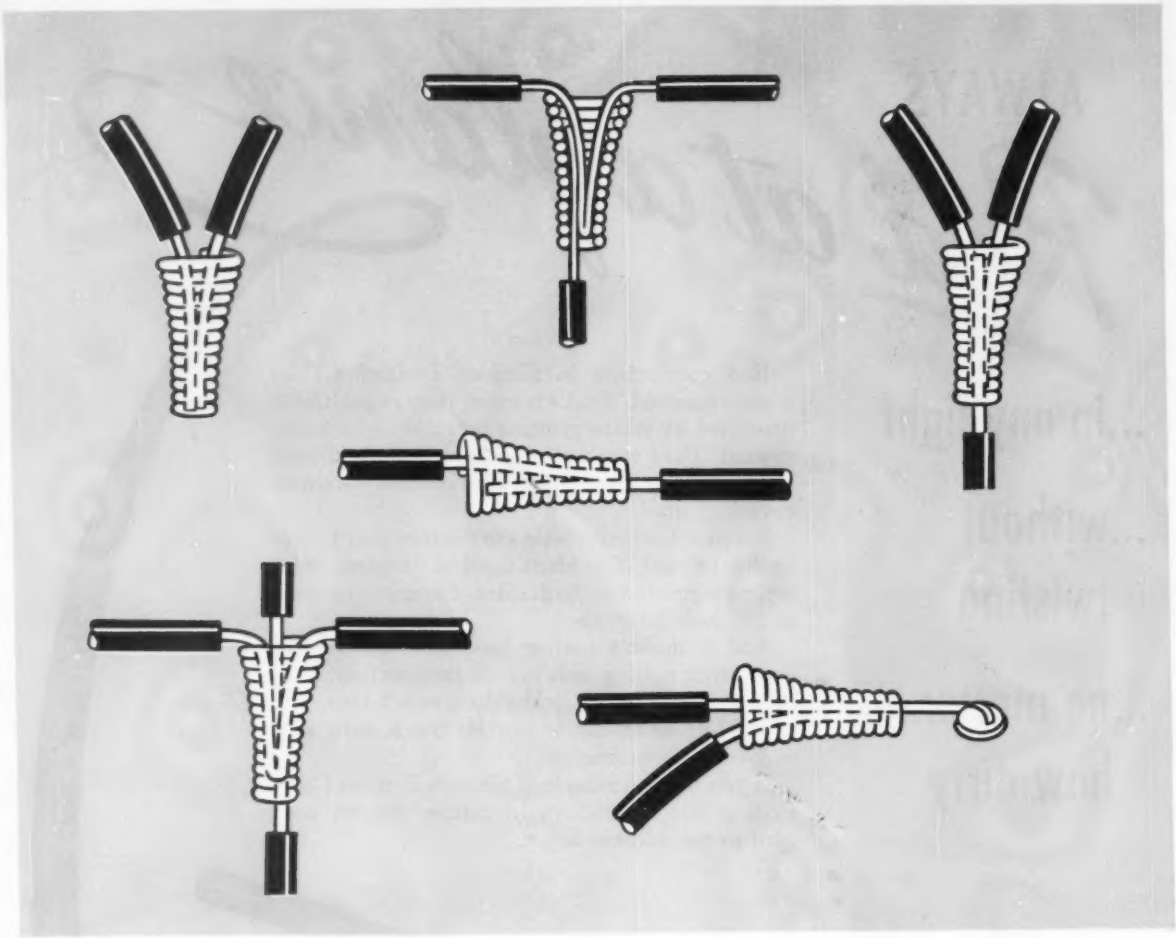
And it doesn't matter how dirty conductors get during pulling, splicing, or termination. Simplex Printed Color Coding just won't blur, rub off, or lose its ability to provide quick, safe, sure conductor identification.

If you'd like a sample of Simplex Printed Color Coding and descriptive literature, drop a post card to the address below.

Simplex CONTROL CABLES

with **PRINTED** COLOR CODING

SIMPLEX WIRE & CABLE CO., 79 Sidney Street, Cambridge 39, Massachusetts



"Scotchlok" makes all these splices

(and "Scotchloks" never shake loose!)

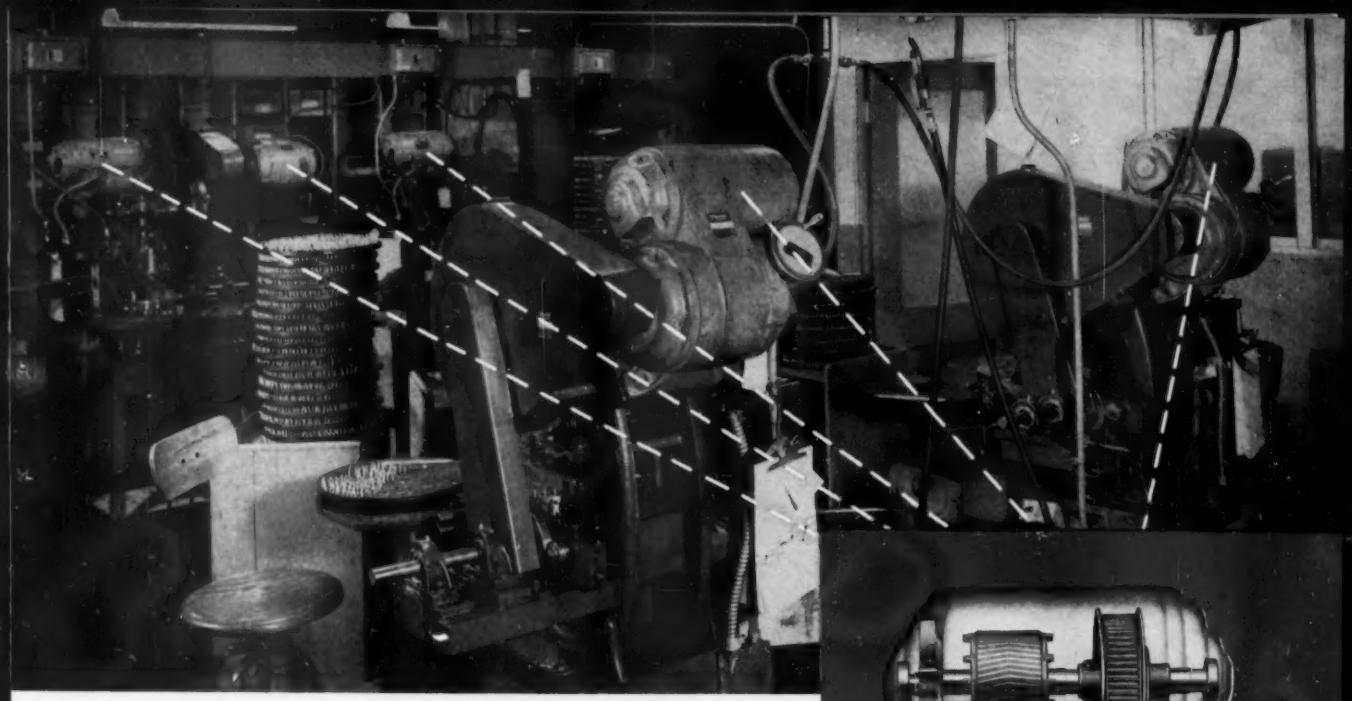
Look at what "Scotchlok" can do! Pigtail splices, "T" splices, "Y" splices, 4-wire crosses—and plenty more. You see, "Scotchlok" is the only steel spring wire connector that lets you insert wires from *both* ends. It's an exclusive, patented design.

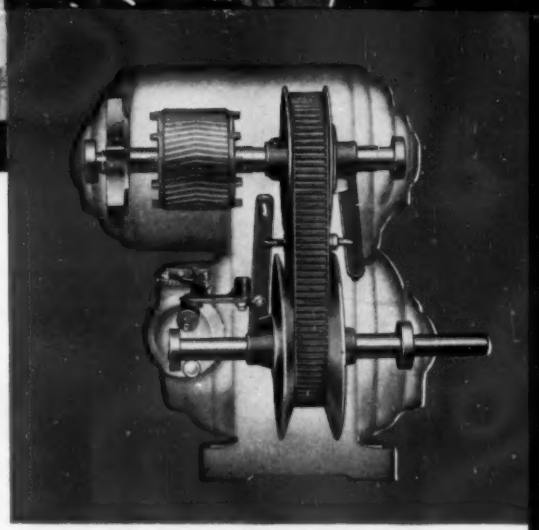
That's reason enough for specifying "Scotchlok"—yet look at the other advantages. The steel spring construction grips the wires tight—actually *threads* the wires for extra-strong hold. "Scotchlok" never shakes loose. The coils give a constant-tension grip of great strength over the entire splice area. "Scotchlok" is easy to apply—just twist it on. Wrap with "Scotch" 33 Plastic Electrical Tape and you have the world's safest, most compact splice—one that can't shake loose . . . ever!

"Scotchlok" is now available in four sizes for wire gages from 18 AWG to 2 AWG. Order a trial supply today or write for more information.

"SCOTCHLOK" Electrical Spring Connectors

The term "Scotchlok" is a registered trademark of **Minnesota Mining and Mfg. Co., St. Paul 6, Minn.** General Export: 122 E. 42nd St., New York 17, N.Y. In Canada: London, Ont., Can.





CHERRY RIVET CO. INCREASED PRODUCTION, CUT COSTS WITH SPEED-TROLS

Sterling Speed-Trols are aiding in faster, more economical production of our patented Cherry Blind Rivet, reports Mr. Milo Ketchum, Chief Engineer of Cherry Rivet Company, Los Angeles. Speed-Trols were selected to drive our specially designed automatic upsetting machines because of their accurate speed selection, positive pulley adjustment, compactness, smooth, quiet operation. We have used Speed-Trols for over five years without one bit of repair cost.

Speed-Trol...Variable Speed at its Best

OUTSTANDING FEATURES:

A Single, Compact Power Unit containing motor, variable speed transmission, with or without integral speed reducer—**Effective Cooling Systems** with direct-through ventilation, dual or internal cooling—**Positive Pulley Adjustment** for infinite speed variation, accurate speed selection and regulation—**Fingertip Control of Speed** with standard or remote controls—**Specially Designed V-Belt** for heavy duty, long life—**Protected Designs,** drip-proof, splash-proof, totally enclosed—**Rugged Construction** for continuous duty, permanent bearing alignment—**Streamlined** for easy cleaning, better appearance—**Interchangeable Mounting Dimensions** between constant and variable speed drives—**Versatile Mounting** for any position—**Smooth, Quiet Operation** through dynamic balancing; Herringbone Rotor; pre-lubricated, double shielded ball bearings—**Low Installation Cost** due to compact design, versatile mounting, interchangeable mounting dimensions.

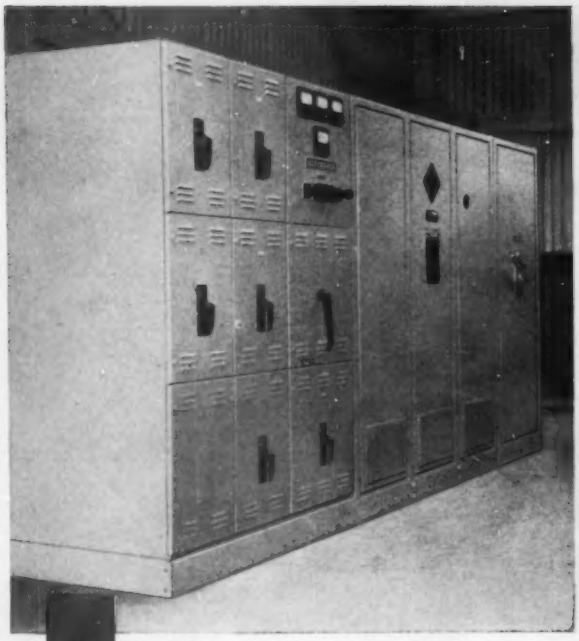
20-PAGE ILLUSTRATED CATALOG ... Sterling Speed-Trol, Slo-Speed, Klosd and Klosd-Tite Electric Power Drives. Write for catalog L-416.

There is a Sterling Electric Power Drive to Meet Virtually Every Requirement

Sterling Slo-Speed Electric Power Drives—for geared low speed at its best
Sterling Klosd and Klosd-Tite Motors—for constant normal speed at its best

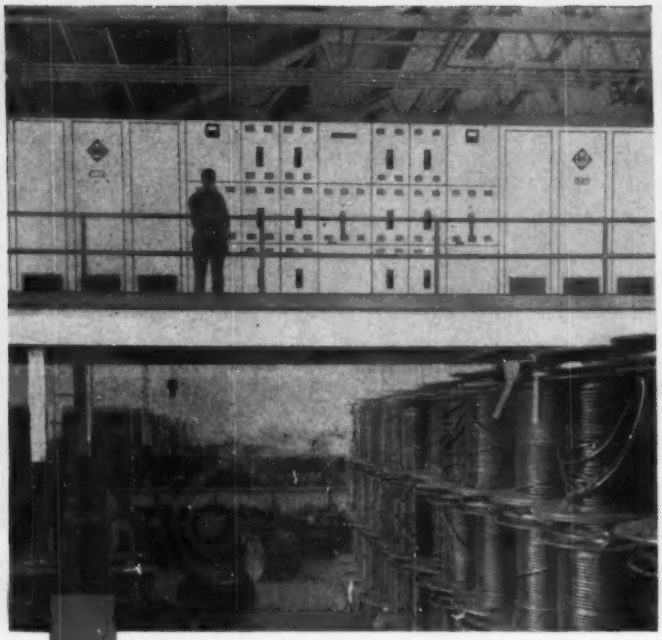
STERLING ELECTRIC MOTORS

Plants: New York City 51 • Chicago 35 • Los Angeles 22 • Hamilton, Canada • Santiago, Chile
Offices and distributors in all principal cities



ON ROOF

Here's a spot out of the way of production flow — ideal for a unit substation. Lines to machines are short and direct. Either outdoor units or indoor units inside an enclosure can be used.



ON BALCONY

Here's another way to conserve valuable floor area! Substation is out of the way — yet right where it does the most good. While construction of balcony must be sturdy, it need not be expensive.

THERE'S ALWAYS

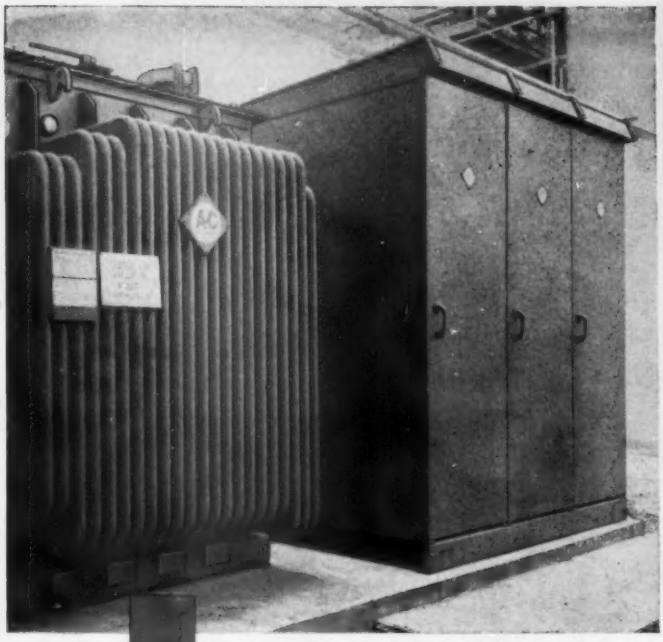
Modernize electrically with Allis-Chalmers switchgear placed in nonproductive space

• Bringing high voltage lines close to load centers is no problem with compact Allis-Chalmers unit substations. They fit anywhere . . . on the roof . . . on a balcony . . . in the basement . . . or outside near the building.

• Allis-Chalmers unit substations simplify the problem of keeping electrical distribution in step with increased power usage; help you get full production out of tools and equipment; and help you improve operating costs.

A-C ALLIS-CHALMERS

ALLIS-



NEAR BUILDING

If indoor atmosphere is hazardous or floor space and overhead space are at a premium, outdoor weatherproof unit substations can be placed near building.

IN BASEMENT

Where basement-located pumps or compressors are the main load or where machinery is light in weight, substations are often placed under the main floor.

ROOM

GET COMPLETE INFORMATION

Let experienced Allis-Chalmers switchgear engineers help you solve your distribution problems. Call your nearby A-C district office, or send for new 24-page bulletin "Power at Load Centers Pays Off" (11B6285B). Allis-Chalmers, Milwaukee 1, Wisconsin.

AVOID THESE LOSSES BY USING UNIT SUBSTATIONS

Reduced Motor Torque — Torque and horsepower drop when voltage drops. Unit subs improve voltage by shortening low voltage cable runs.

Power Interruptions — Special circuit schemes on standard Allis-Chalmers switchgear permit removal of breakers without power interruption.

Prolonged Down Time — Many old breakers are now inadequate and a fault could cause down time.

High Moving Costs — Packaged unit subs and bus duct cut equipment relocation costs.

Lost Dryer Output—10% undervoltage cuts output of infrared oven 15%.

Lost Overload Capacity — Overload capacity drops about 10% for every 5% below rated voltage.

High Cable Costs — Savings in cable alone can go a long way toward modernizing a distribution system.

A-4246

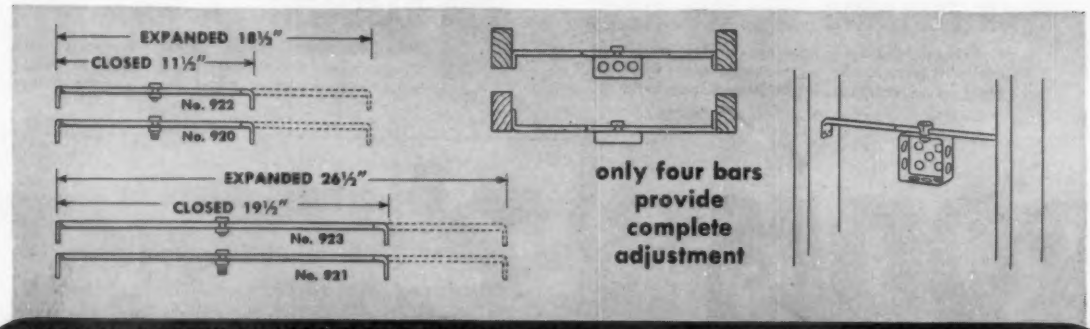
CHALMERS

NOW! RACO OFFERS

the first adjustable bars that fill every requirement... pass every test!

ONLY 4 BARS ENABLE YOU TO INSTALL ANY DEPTH BOX WHEREVER YOU WANT IT REGARDLESS OF STUDDING SIZE OR SPACING

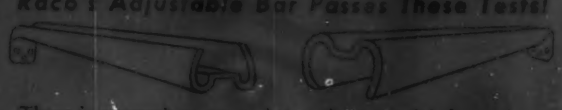
STOCK JUST 4 BARS INSTEAD OF 16



NORMAL SAFETY PRECAUTIONS REQUIRE THAT A BAR MUST WITHSTAND THESE TESTS

1. Direct pull on stud of 200 pounds for 5 minutes.
2. Six rotations of a 50 pound pull, 20" away from stud at a 30° angle in one minute.
3. A torque of 20 pounds at 20° horizontally from stud for one minute.

Raco's Adjustable Bar Passes These Tests!



There is strength to spare due to these special formations!

Use Raco's New Clip or Popular Stud!

The new Raco Clip uses a strong new saddle of 13 gauge steel, formed steel clip and short, strong No. 14-20 round head screw.

Popular Raco Stud uses the same saddle, a formed 13 gauge steel stud with six full, deep No. 20 threads and a stout No. 14-20 screw.

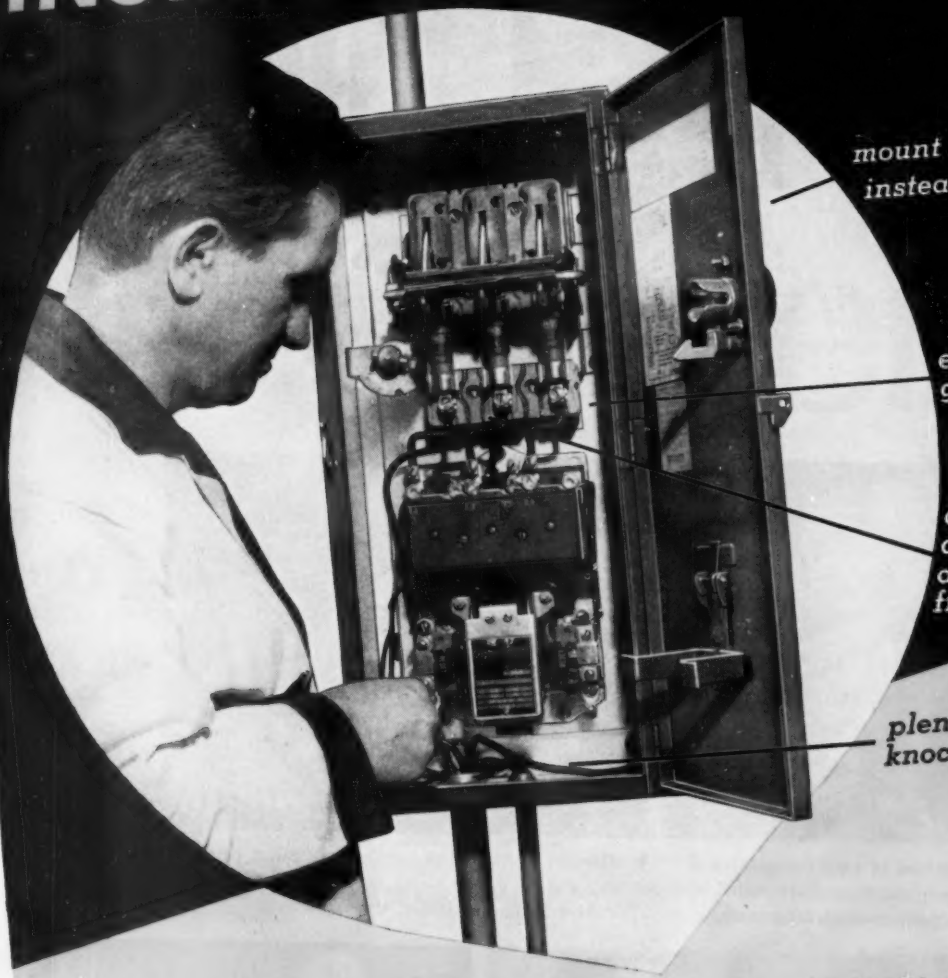
Raco Clip provides ample room for device and added wiring space in any type box.

WRITE TODAY • get complete information on Raco Bar Hangers

YOU CAN ALWAYS DEPEND ON RACO

ALL-STEEL EQUIPMENT INC., Aurora • Illinois

EASIER TO INSTALL AND MAINTAIN!



mount 1 device instead of 2

extra-wide gutters

all components accessible from front

plenty of knockouts

SQUARE D COMBINATION STARTERS

(Switch or Circuit Breaker Types)

Save space and time. Mount and wire one device instead of two . . . neater, more attractive installations.

Write for Bulletins 8538 and 8539
Square D Company, 4041 N. Richards Street, Milwaukee 12, Wisconsin

ASK YOUR ELECTRICAL DISTRIBUTOR FOR SQUARE D PRODUCTS

SQUARE D COMPANY

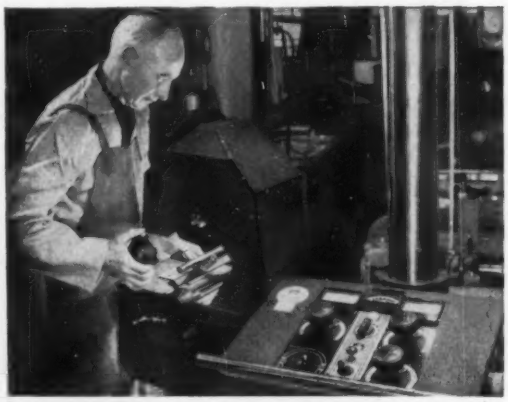
Don't buy just "Type RR" High Voltage Cable

Phelps Dodge Habirite

Experimental compound of high voltage, butyl rubber insulating material is carefully milled in Phelps Dodge's extensive research laboratory.

Habirite butyl rubber insulation is shown being exposed to severe ozone conditions in one of Phelps Dodge's exacting laboratory tests.

Habirite-Habirprene cable being checked for corona level, an important step in assuring safe operation of finished product.



X-Ray machine used to carefully examine quality of cable insulation, also detects defects, porosity and foreign matter, helps eliminate faulty cable.

....Specify the finest!—Habirprene

Rely on this highest quality cable—it works where others fail

The term "RR" is just a name, not an assurance of quality. When you order high voltage RR cable, insist on Phelps Dodge Habirite-Habirprene—developed through years of experience in designing and making high voltage cables. Habirite-Habirprene exceeds the trade's highest standards of quality and reliability.

Phelps Dodge Habirite insulation, a specially engineered butyl rubber compound, has a service dependability record unapproached by any other type of rubber insulation. Habirite is greatly superior to old-fashioned insulations for these reasons:

- Much greater resistance to heat and oxidation. This permits a higher temperature rating, with consequent reduction in conductor size and in cable cost.
- Much greater resistance to ozone—present around high voltage equipment.
- Much greater mechanical toughness affording maximum protection against damage from tools, stones and other installation hazards.
- Better electrical properties—giving a greater safety factor in operation.
- Maximum uniformity of finished product—due to controllable uniformity of raw materials.
- Elimination of laminations which cause weak spots—through use of Phelps Dodge extrusion insulating process.

Phelps Dodge Habirprene sheath, a unique neoprene compound, is especially made to be extra resistant to corona, one of the worst enemies of high voltage cable. This *extra resistance to corona* is an exclusive Phelps Dodge feature. It provides a greater safety factor in operation and has contributed to the remarkable reputation and service record of Habirite-Habirprene.

When you specify Habirite-Habirprene, you are assured of getting RR cable with the utmost in safety and durability. Habirite-Habirprene is the result of Phelps Dodge's rigid quality standards, long experience, expert engineering and vast facilities.

PHELPS DODGE COPPER PRODUCTS CORPORATION

SALES OFFICES: ATLANTA, 903 Candler Bldg.; BOSTON, 20 Providence Street; BUFFALO, 180 Perry Street; CHARLOTTE, 213 West First Street; CHICAGO, 100 West Monroe Street; CINCINNATI, 18 East Fourth Street; CLEVELAND, 816 Superior Avenue, N.E.; DALLAS, 3113 McKinney Avenue; JACKSONVILLE, 33 S. Hogan St.; DETROIT, 28 West Adams Avenue; FORT WAYNE, 4400 New Haven Avenue; GREENSBORO, N. C., P. O. Box 2643; HOUSTON, 3517-19 Polk Avenue; KANSAS CITY, MO., 406 West 34th Street; LOS ANGELES, 6100 Garfield Avenue; MILWAUKEE, 2408 N. Farwell Avenue; MINNEAPOLIS, 5009A Excelsior Blvd.; NEW ORLEANS, 1009 Carondelet Bldg.; NEW YORK, 40 Wall Street; PHILADELPHIA, 1617 Pennsylvania Blvd.; PITTSBURGH, 1532 Oliver Bldg.; PORTLAND, ORE., 1220 S.W. Stark St.; RICHMOND, 113 E. Cary St.; ROANOKE, 3645 Martinel Avenue, Castle Heights, S.W.; ST. LOUIS, 1221 Locust Street; SAN FRANCISCO, 369 Pine Street; SEATTLE, 505 Skinner Bldg.; WASHINGTON, D. C., 14th and "F" Sts., N. W.

Extra DOLLAR VALUE IN GOLD SEAL TAPES

Gold Seal **PLASTIC** electrical tape, for example, gives you more "coverage" per roll. A few neat wraps and the job's finished — gives all needed dielectric on most jobs. Single 60 ft. rolls, cellophane protected, are packed in round metal cans. "Tape-saver" 20 ft. rolls, sized to meet average job needs and "swing" easy in tight places, are packed in 10-roll Handy Pack containers. Sample free on request. Jenkins Bros., Rubber Division, 100 Park Avenue, New York 17.

JENKINS

Gold Seal Tape

FRICTION • RUBBER • PLASTIC

Also Diamond Seal Friction and Rubber Tapes made to ASTM specifications. Products of Jenkins Bros. — makers of famous Jenkins valves.

what do you EXPECT of a "hot" line STIRRUP CLAMP?

★ ABW DESIGN MEANS QUALITY plus STRENGTH in the RIGHT PLACES!

- NO CONDUCTOR ARCING DAMAGE?
- QUICK, EASY INSTALLATION ON A "HOT" LINE?
- POSITIVE, EFFICIENT TIGHTENING WITH "HOT-STICK"?
- LARGE CONTACT AREAS?
- LONG, TROUBLE-FREE SERVICE?

ANDERSON answers **all** your requirements with a brand new one-piece **"Hook-over" Hotline Stirrup Clamp** . . . TYPE AHLS . . . designed for time-saving installation, longer service life and rugged, efficient dependability in service.

The heat-treated clamp body, cap and eye are high-strength cast aluminum alloy. Copper stirrup loops are serrated and compression-bonded into the clamps . . . **can't pull out!** Bolts are furnished with both flat and split washers. Hinge pins are stainless steel, and all other hardware parts are alumilite-finished high-strength aluminum alloy.

FOR MORE COMPLETE INFORMATION consult your nearest ABW representative or contact our home office.

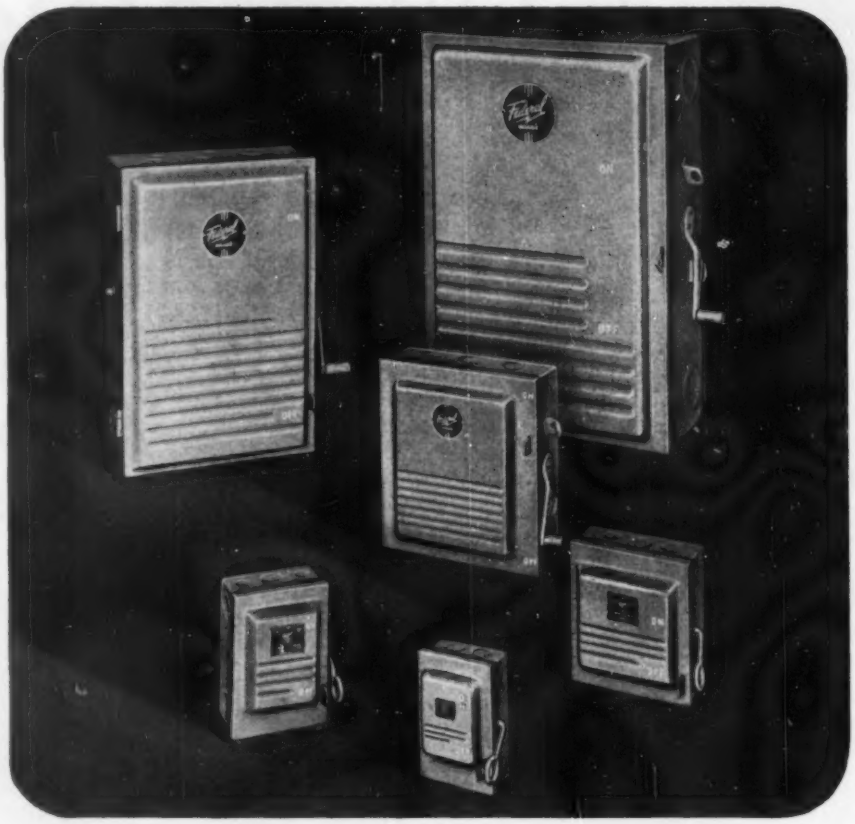
ABW

Aluminum & Bronze POWER CONNECTORS • CLAMPS • FITTINGS • ACCESSORIES
for SUBSTATION • TRANSMISSION • DISTRIBUTION SYSTEMS *for over a Quarter Century*

ANDERSON BRASS WORKS, INC.

P. O. DRAWER 2151 • BIRMINGHAM 1, ALABAMA

NEW FEDERAL NOARK® BRING YOU THESE



TAKE YOUR PENCIL and check the list of values in this new Type D Safety Switch line. These switches are available in 30, 60, 100, 200, 400 and 600 amp. capacities, in both general purpose and raintight enclosures.

DEPENDABLE

- ☐ Simple, dual knife blade construction.
- ☐ New patented high-pressure fuse holders.
- ☐ Large, rugged current-carrying parts.

INSTALLATION EASE

- ☐ Generous wiring gutters.
- ☐ Solderless connectors.
- ☐ Neutrals connected for direct feed through wiring.
- ☐ Knockouts . . . right size and in the right places.

SIMPLE MAINTENANCE

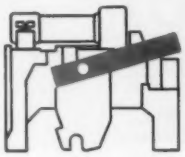
- ☐ Moving parts and making and breaking contacts clearly visible for inspection and maintenance.

STYLING

- ☐ Smart and modern.
- ☐ Uniform design ensures high standards of performance.
- ☐ Attractive appearance of completed installations.
- ☐ Enclosure dimensions are smaller than ever.

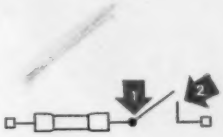
TYPE D SAFETY SWITCHES PLUS VALUES —

CHECK THESE 30 AMP. PLUS VALUES!



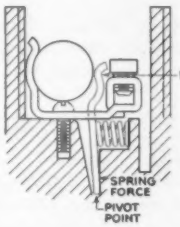
☐ **VISIBLE KNIFE BLADES**

With cover open, shows at a glance if switch is in "On" or "Off" position.



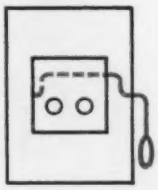
☐ **MINIMUM NUMBER OF JOINTS**

Wrap around lug and bus construction minimizes number of heat-creating joints; assures cool operation.



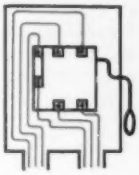
☐ **HIGH PRESSURE FUSE HOLDER**

Coil spring type located in block beneath the fuse and unaffected by its heat. Holds fuse in a vise-like grip.



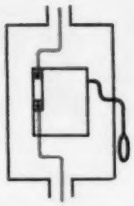
☐ **FUSES ACCESSIBLE**

Operating crossbar **under** the switch block provides full access to fuses.



☐ **AMPLE GUTTER SPACE —**

Wide, unobstructed gutter space eliminates need for threading wire under operating crossbar.



☐ **FEED-THROUGH NEUTRAL —**

Whether coming in at top or bottom, feed-through neutral is always readily accessible for easy wiring.

Add these up and you will agree that the new feature-packed Federal Noark Type D Safety Switch line is the one for you. And remember... many of these advanced features are incorporated in the 60, 100, 200, 400 and 600 amp. switches.

Write for your copy of this new book on Federal Noark feature-packed Type D Safety Switches

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FORMERLY— FEDERAL ELECTRIC PRODUCTS COMPANY AND PACIFIC ELECTRIC MANUFACTURING CORP.

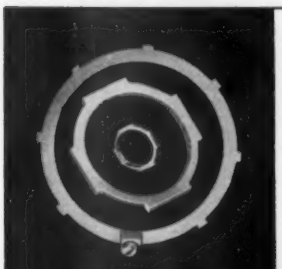
Main Office: 50 PARIS STREET, NEWARK 1, N. J.

Federal Pacific products: Stab-lok Circuit Breakers, Motor Controls, Safety Switches, Service Equipment, Industrial Circuit Breakers, Panelboards, Switchboards, Control Centers, Bus Duct. High voltage circuit breakers and power switches ★ Sales offices in principal cities.

ANY FITTING YOU CAN THINK OF!

Gedney's got it . . . in malleable iron . . . accurately machined . . . quickest, least costly to install

IT'S RIGHT THERE in the Gedney line . . . every fitting that you need for every sort of installation! And Gedney fittings are accurately machined and threaded . . . made of unbreakable malleable iron . . . individually inspected to assure you the lowest installed costs obtainable today! Always order Gedney fittings and you'll *always* make maximum savings of time and money.

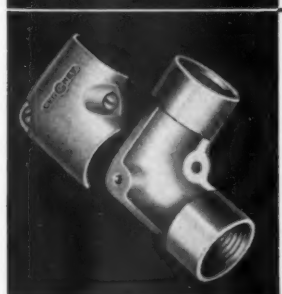


CONDUIT LOCKNUTS — sizes from ⅜" to 6". Sizes ⅜" to 1½" are made of heavy nut lock steel . . . all other sizes, malleable iron. All sizes cadmium plated. Also bonding wedge locknuts, ½" to 6".

3-PIECE CONDUIT COUPLINGS — come in a large range of sizes from ½" to 6". Malleable iron, cadmium plated.

CAPPED BUSHINGS—available in a standard range from ½" to 6". Made of unbreakable malleable iron, cadmium plated.

PIPE STRAPS — CLAMP BACKS and NEST BACKS — 1 hole — for rigid E.M.T. and service entrance cable. Available in a full range of standard sizes. Malleable iron, hot dip galvanized.



CORNER PULL-IN ELBOWS — made in ½", ¾", 1", 1¼", 1½," and 2" sizes. Outstanding for space saving, machine wiring, easy wire pulling. Malleable iron, cadmium plated.

NAIL STRAPS — for rigid E.M.T. and S.E. cables with O.D. of .706 to 1.163 inches. In sizes ½", ¾", and 1". Malleable iron, cadmium plated.

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GEDNEY
ELECTRIC COMPANY

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RKO BLDG. • RADIO CITY • NEW YORK 20
Foundry, Factory and Shipping Point: Terryville, Conn.

Paired Fixtures show LITECONTROL Flexibility

INSTALLATION: Niagara Mohawk Power Corporation, Electric Building, Buffalo, New York
ILLUMINATING ENGINEER: Mr. J. F. Parsons, Niagara Mohawk Power Corporation
AREA: Customer's Service Office — 77' x 40'
CEILING HEIGHT: 11'-6"
FIXTURES: Litecontrol No. 3724, with Holophane No. 9016 lenses, 2-F96T12 standard warm white lamps; fixtures arranged in double rows
SPACING: 10' on centers
REFLECTION FACTORS: Ceiling 80%, walls 50%, floor 30%, desk tops 30%
INTENSITY: 90 Footcandles in service
BRIGHTNESS READINGS ON LENSES:
70 degrees — 180 footlamberts
60 degrees — 270 footlamberts
45 degrees — 950 footlamberts
0 degrees — 1800 footlamberts

Striking good looks mark this unusual solution to office lighting problems. Standard LITECONTROL 3724 shallow "surface troffers" were mounted side by side, forming a double width unit which gives high intensity light with very little increase in brightness.

Adjacent glass side panels were omitted and the fixtures joined by means of small clips. Installation was simple and rapid. Although joined into a single unit, fixture doors still swing fully open on hinges, at a finger's touch on the *snap-lock* triggers, for easy cleaning and maintenance.

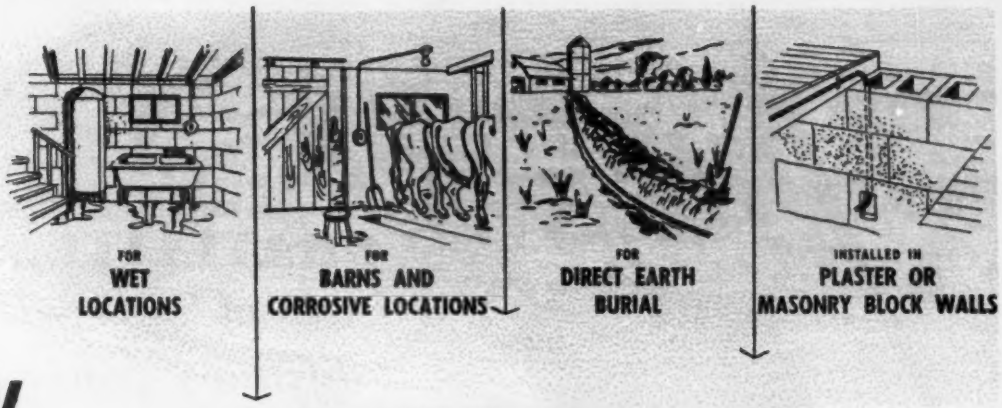
Holophane low brightness lenses, diffusing glass side panels and light-toned interior decoration complete a picture of outstanding lighting for day-long office comfort . . . *custom lighting* with *standard fixtures*. Let us show you how LITECONTROL efficiency and versatility can work for you. Call or write your local representative today.

LITECONTROL *Fixtures*

KEEP UPKEEP DOWN

LITECONTROL CORPORATION, 36 Pleasant Street, Watertown 72, Massachusetts

DESIGNERS, ENGINEERS AND MANUFACTURERS OF FLUORESCENT LIGHTING EQUIPMENT DISTRIBUTED ONLY THROUGH ACCREDITED WHOLESALERS



NEW Columbia-UF

UNDERGROUND FEEDER AND BRANCH CIRCUIT CABLE

Columbia-UF cable is a specifically designed thermoplastic cable tested and approved by Underwriters' Laboratories, Inc. and recognized by the National Electric Code (1953) for use in wet, damp or corrosive locations. It is approved for direct earth burial in branch and feeder circuits when provided with overcurrent protection. Columbia-UF is highly resistant to acids, alkalis, lubricants, corrosive fumes and water. It resists fungus and corrosion and will not support combustion.

Columbia-UF is available in sizes 14/2, 12/2, 10/2 with and without ground; 14/3, 12/3 and 10/3 without ground wire; in single conductor in sizes #14 to #4 AWG.

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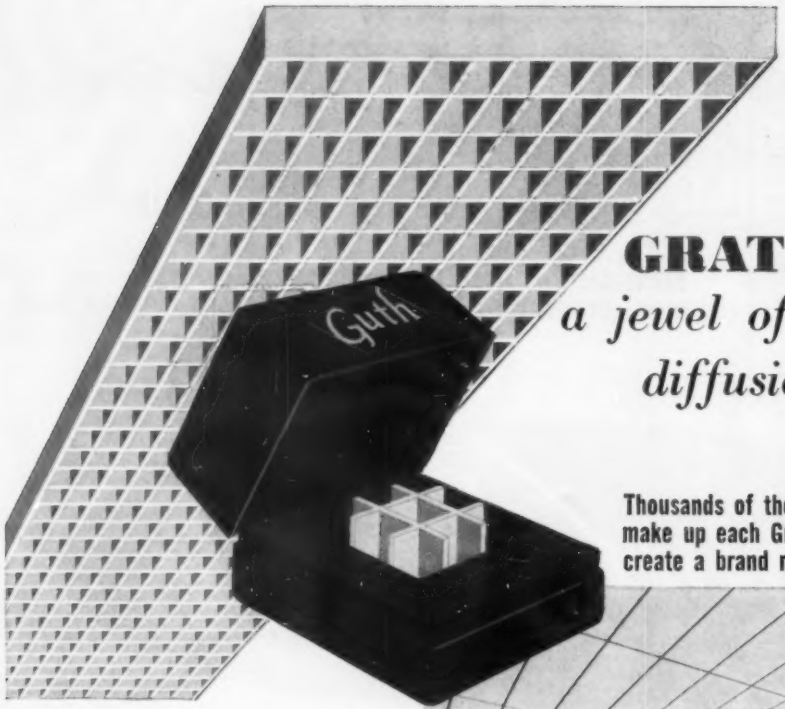
Serving the Electrical Wholesaler Since 1912

255 Chestnut St. **Brooklyn 8, N. Y.**



GRATELITE...
a jewel of sight-saving diffusion power

Thousands of these cubes make up each GrateLite panel... and create a brand new kind of light.

FINE DIFFUSION... the cubicles appear to blend into one solid, luminous mass. Its surface is 30% vertical members!

HIGH EFFICIENCY...translucency and openness, tapered vanes, shallowness (3/8")—these assure highest illumination values with low absorption factor.

LOW BRIGHTNESS ...its vanes with contrasting cubicles and "in shadow" characteristics render light of extremely low brightness without an effect of dimness.

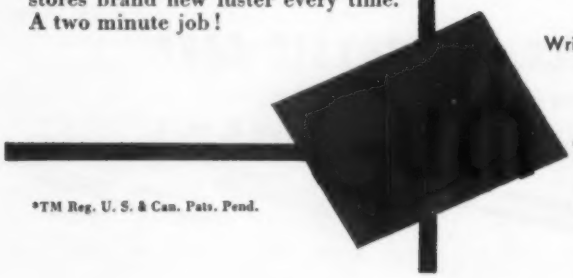
EXCELLENT SHIELDING . . . exclusive 45° x 45° shielding method (with 3/8" cubes) gives greater eye protection than any other louver with larger openings.

LOW MAINTENANCE . . . GrateLite *stays* clean—bugs and dust drop right through. Quick, easy washing restores brand new luster every time. A two minute job!

AND MORE! GrateLite's closely spaced vanes make it rugged to stand severe usage. It provides efficient AIR CONDITIONING DIFFUSION... and filters out a portion of room noise.

It's all in the sight-saving cubes—and only GrateLite has them!

Write for free booklet "The GrateLite Story" today.



THE EDWIN F. GUTH COMPANY ST. LOUIS 3, MO.

Leaders in Lighting since 1902

*TM Reg. U. S. & Can. Pats. Pend.

New Style Shipping Crate Cuts Transformer Warehousing Costs

CRATE BOTTOM is a re-usable pallet. After transformer is uncrated you can remove pallet and use it for handling other materials.

CRATED DISTRIBUTION TRANSFORMERS can be moved fast and efficiently with Allis-Chalmers new style shipping crate. With the new crate, it is easier to move transformers with a fork truck because the crate bottom is a pallet to permit easy loading.

Stacking is easier too. Side bracing distributes loads so effectively that it is no longer necessary to use wooden runners between layers of stacked crates. Crates are built of quality lumber. The tops and bottoms key with the tops and bottoms of adjacent crates. Crates can be stacked higher and more safely than ever before.

Local Stocks Available

Allis-Chalmers maintains local stocks of conventional distribution transformers as well as self-protecting and overload indicating types. All are available in most popular ratings. These stocks, in addition to your own transformer supply, assure a solution to your distribution transformer problem when you need it — where you need it.

Take stock of your transformer needs today. To get more facts on availability and ease of handling of Allis-Chalmers distribution transformers, contact your local A-C office or distributor or write Allis-Chalmers, Milwaukee 1, Wisconsin.

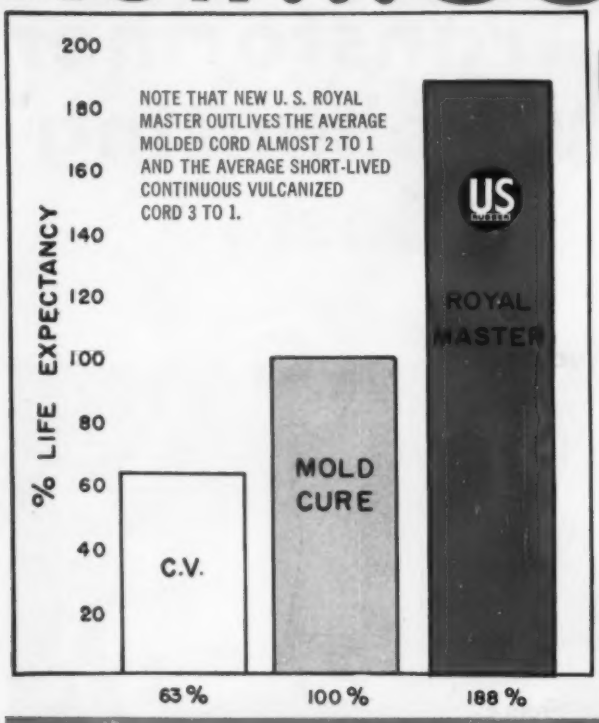
A-C ALLIS-CHALMERS

A-4425

ALLIS-CHALMERS

Now...88% longer

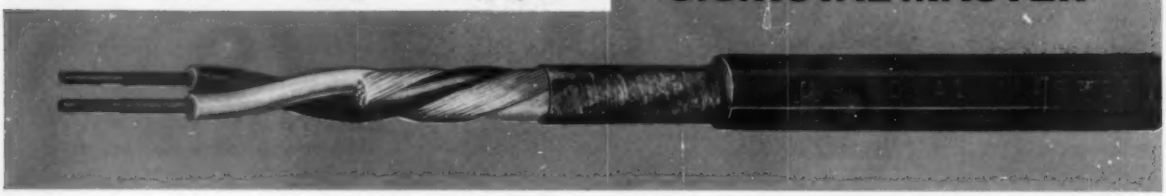
U.S. ROYAL



Chart—summarizing individual service factors weighted by their contribution to overall service life—shows new U. S. Royal Master Cord gives 88% longer life than the average of competitive molded cords.

LOOK FOR THE NAME—

U.S. ROYAL MASTER



Superior on every count!*

- 33.3% greater heat resistance
- 55.7% greater impact strength
- 53.8% greater abrasion resistance
- 30.6% greater resistance to cutting
- 110.3% greater resistance to tearing
- 21.2% greater tension or breaking strength
- 23.3% greater oil resistance
- 128.8% greater flexibility

*to the average of molded cords of other makes

US RUBBER

UNITED STATES

ELECTRICAL WIRE AND CABLE DEPARTMENT

cord life—with NEW MASTER portable cord!

Far outlasts *any* other cord made!

Service to cost ratings show new U. S. Royal Master Cord actually gives $1.88 in value for every cord dollar when compared to the average competitive molded cord!

Two years ago, "U. S." engineers began a *complete reexamination* of portable cord construction, service life, and the causes of cord failure.

Over 10,000 tests were made. More than a thousand cords of all leading makes, including our own famous U. S. Royal Cord, were analyzed, tested, and compared.

Every life factor was considered and carefully evaluated, alone and in its relation to overall cord performance and service life.

Backed by 64 years of experience in the manufacture of electrical wire and cable, U. S. Rubber engineers then translated their findings into an entirely new portable cord, designed to surpass any other previously made.

Extensive tests, both in the laboratory and in outside plant installations have proved this new portable cord startlingly superior in every respect!

New U. S. Royal Master is unquestionably the finest cord you can buy!

From every standpoint, new U. S. Royal Master is a finer, more durable cord — actually gives 88% longer life than the average of other molded cords — far longer than *any* other cord — surpassing even a *hypothetical* cord incorporating the best features of all those tested!

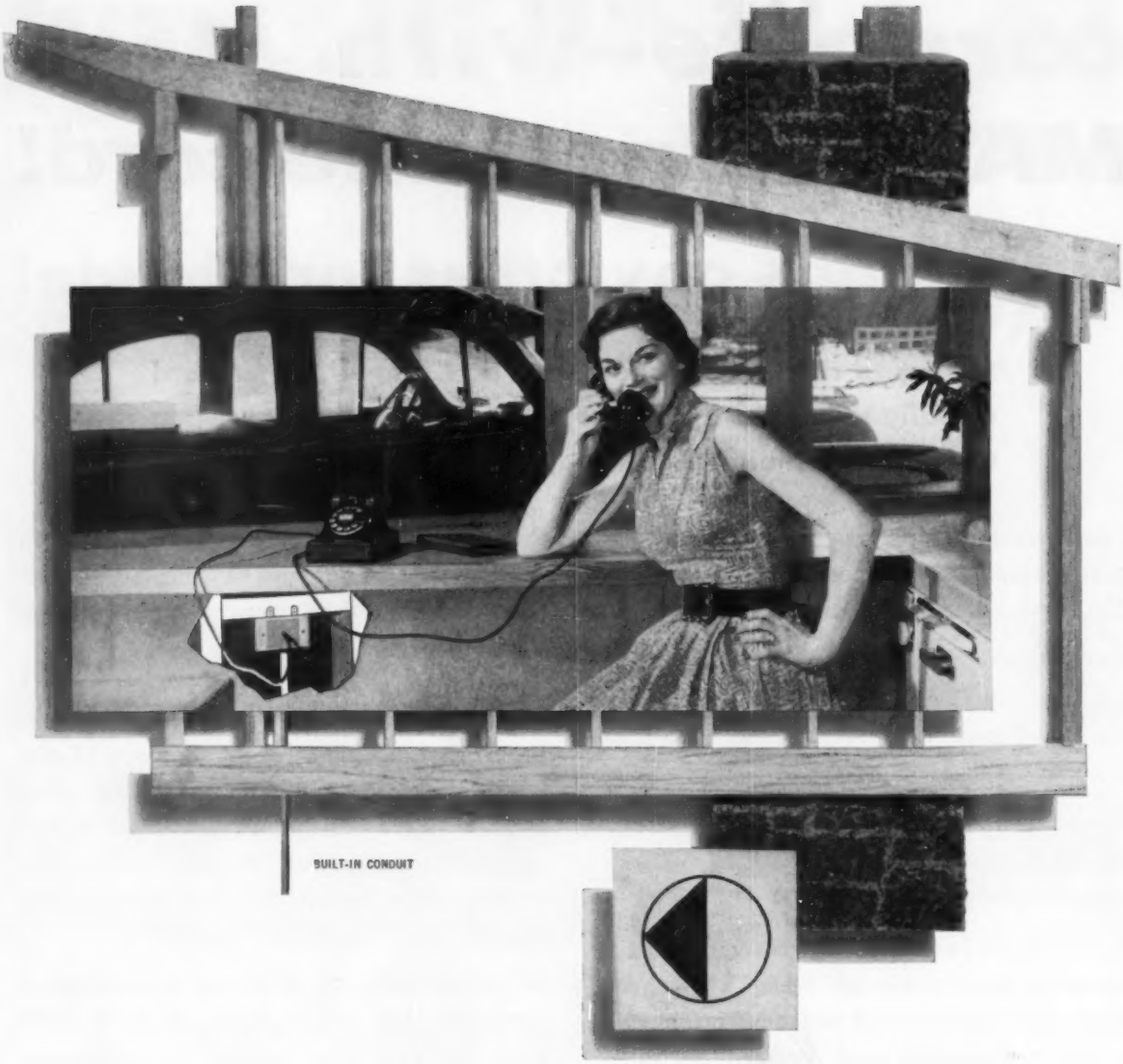
Far greater value, too! In spite of almost doubled service life, this great new cord is in the same price category as other molded cords—giving you $1.88 in cord value for every cord $1.00!

Prove to yourself the outstanding superiority of new U. S. Royal Master Portable Cord — in both service life *and* economy! Get in touch with your "U. S." distributor today!

Approved by Underwriters' Laboratories, Inc.

RUBBER COMPANY

ROCKEFELLER CENTER, NEW YORK 20, N. Y.



Telephone service is so much a part of modern living.

To make sure that it is available in the right places (bedroom, kitchen, den and hall)—and that the wires are concealed—include telephone conduits in all your electrical contracts for new homes.

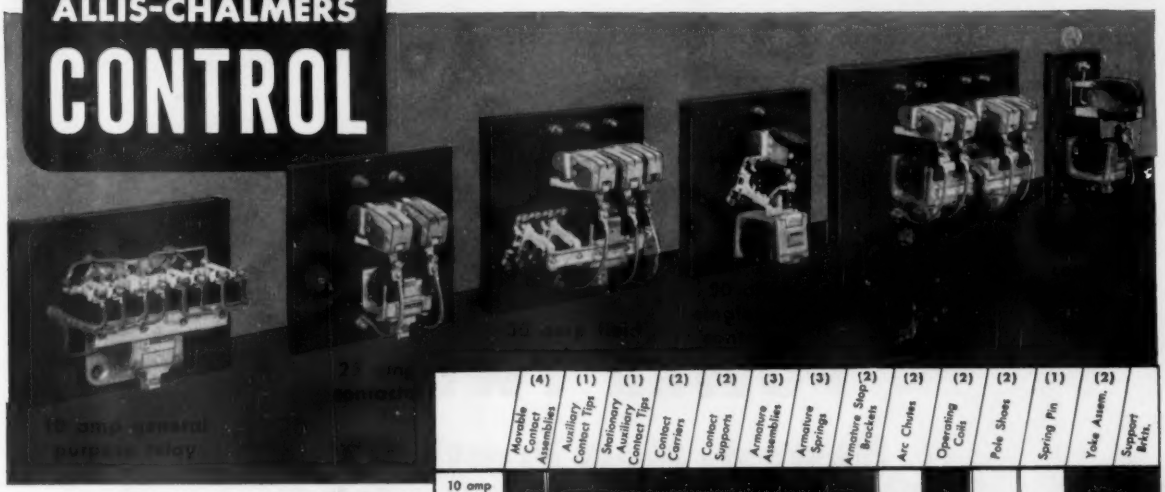
Your Bell Telephone Company will be glad to help you work out economical conduit installations. Just call your nearest Business Office.

BELL TELEPHONE SYSTEM

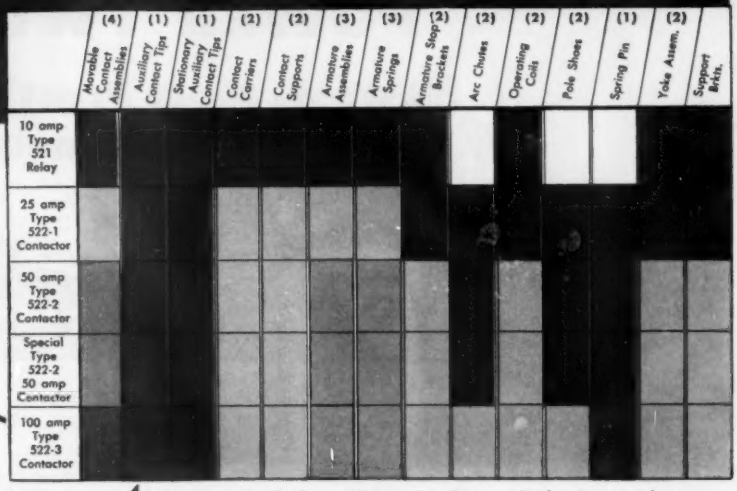
For 10 to 100 AMP applications

Check this New dc Control Line

ALLIS-CHALMERS CONTROL



• This new line of general purpose, heavy-duty dc control starts with a multi-pole auxiliary relay and includes contactors ranging from 25 to 100 amps. The contactors are available in five basic units with optional arrangements of normally open and normally closed main and auxiliary contacts.



Change in color bar indicates size change. Number in parentheses tells how many sizes of that component are needed.

Outstanding Interchangeability of Parts Affords Maximum Convenience and Economy

This chart graphically illustrates the exceptional interchangeability of parts in this new control line. Maintenance is greatly simplified. Only a small inventory of parts is needed to keep these controls operative. The possibility of lengthy, costly "down" periods is practically eliminated.

Other Features — Vertical action contactors have a rolling, self-wiping action. Contactor tips are forged copper. Current-carrying parts are silver plated. All other metallic parts are zinc plated. Relay tips are silver alloy.

A-4448

New Bulletin — Bulletin 14B8171 gives data on the Allis-Chalmers dc line which now covers the *complete range up to 600 amperes.* See your local Allis-Chalmers representative or write Allis-Chalmers, Milwaukee 1, Wis.

ALLIS-CHALMERS

it's new! the oval-cover, flat-back Pylet

The new "OR" series Pylets, with interchangeable features, will meet all electrical conduit fitting requirements for ***machinery wiring . . . plant maintenance . . .*** and ***new construction.***

- Accurate, ferrous alloy casting.
- Tapered, machine cut threads.
- Large, flat back area, easily drilled for secure mounting.
- Roomy, smooth interior facilitates wire pulling.
- Well-rounded edges prevent wire damage.
- Self-retaining cover screws.

Sold only through authorized distributors.
Write for bulletin and names of distributors in your area.

SINCE 1897

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CONDUIT FITTINGS • PLUGS AND RECEPTACLES • LIGHTING FIXTURES • MULTI-VENT AIR DISTRIBUTION

Douglas Aircraft Installs 2 Acres of Multi-Function Wakefield Ceiling in its New Design Center

Aircraft Design Building

El Segundo Division of Douglas Aircraft

Architects and Engineers: Kistner, Wright and Wright Los Angeles

Electrical Contractor: Hoffman and Jacobs Long Beach, Calif.

Licensed Agent: Graybar Electric Company, Inc. Long Beach, Calif.

Unprecedented Electric Ceiling supplied by Wakefield incorporates seven basic services and was installed in its entirety by an electrical contractor.

Here the Wakefield Ceiling realizes its ultimate multi-purpose potential. And here the electrical contractor comes to full stature as a factor in building construction. The complete job of installing over two acres of luminous corrugated Plexiglas panels, with which are integrated acoustical baffles, air diffusers, sprinkler heads, intercommunication loud speakers, power outlets and provisions for carrying telephone cables to point of use—this tremendous job was entrusted in its entirety to an electrical contractor.

Electric Ceiling provides these basic services

- Fully diffused lighting of 90-100 footcandles
- Acoustical equipment for noise control
- Power distribution for electrical office equipment
- Telephone services
- Public address system
- Air distribution and return
- The sprinkler system

In addition the electrical contractor installed the electrical channel housings and assemblies, all designed and built by Wakefield, which support the plastic diffusers and 4000 lamps.

Wakefield is proud to have been chosen to work with the forward-looking management of Douglas Aircraft and their architects and engineers in the planning and building of the world's most advanced aircraft engineering center. Proud, too, to see an electrical contractor play such an important role in the construction of this superb building.

Wakefield has recently prepared new brochures on the Wakefield Ceiling and Wakefield Geometrics which will help the electrical contractor, as well as the building owner, to realize the tremendous advantages of multi-purpose ceilings. Write The F. W. Wakefield Brass Company, Vermilion, Ohio. In Canada: Wakefield Lighting Limited, London, Ontario.

Wakefield Over-ALL Lighting


WAKEFIELD GEOMETRICS


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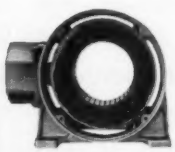
THE STAR


THE WAKEFIELD CEILING

Here's a new line of... DELCO

OPEN FRAME BALL-BEARING MOTORS

Corrosive-resistant cast iron frame. Exclusive cotton and varnish insulation for permanent flexibility and long life.



Grease-lubricated shielded and sealed ball bearings are positioned to maintain permanent shaft alignment.

Rotor is die-cast aluminum, dynamically balanced in unit with shaft to reduce vibration.

New NEMA frame sizes—the major design feature of these greatly improved Delcos—offer users more power in less space, with less noise, less weight, and better appearance. Yet with all these new advantages, there's no sacrifice of performance or electrical characteristics! These are the motors you can order *now* in frame sizes 182 and 184—and get in a hurry. Larger frame sizes—to 326—will be available later. Also, there are new totally-enclosed fan-cooled motors in frame sizes 182 and 184 available now. These two new lines are compact . . . lightweight . . . quiet.

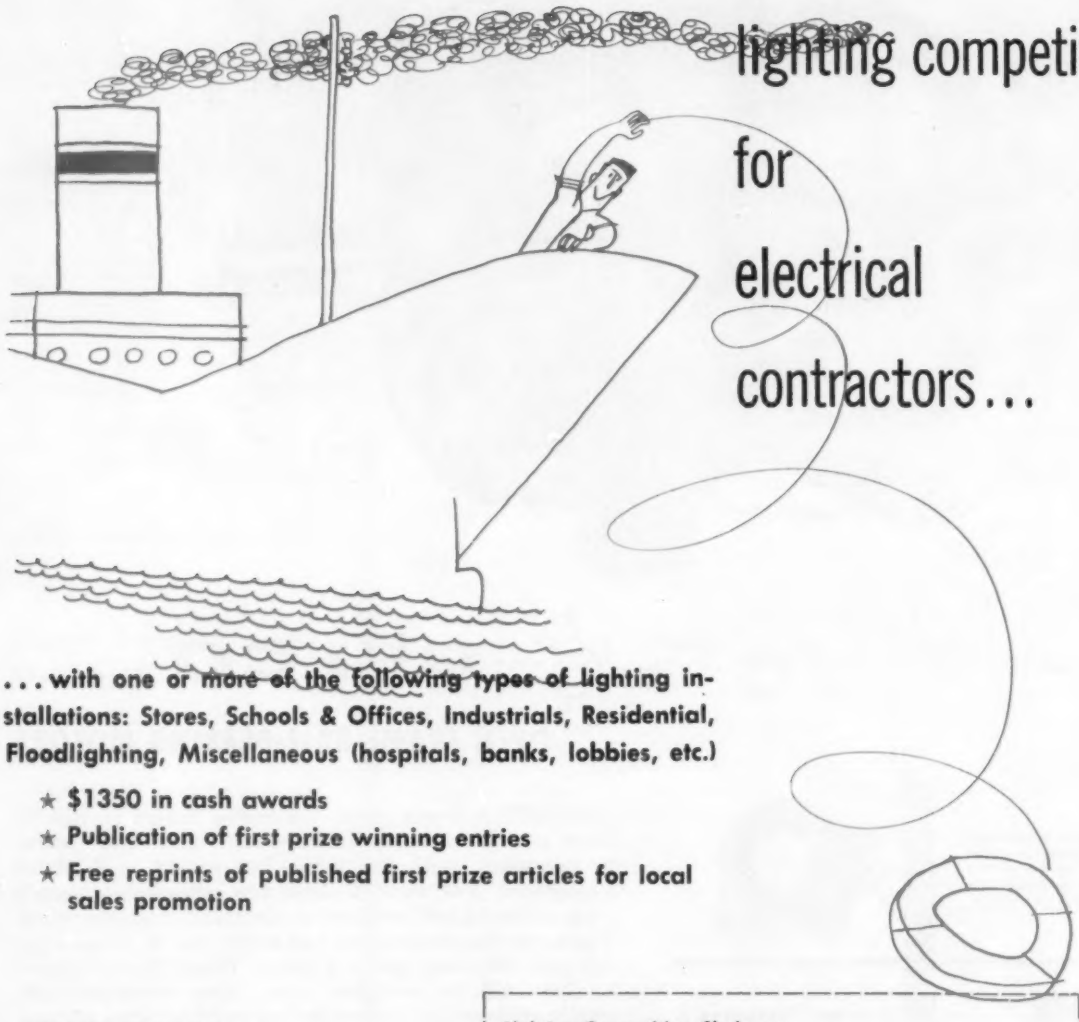
Previous frame sizes will continue to be available

DELCO PRODUCTS
DIVISION OF GENERAL MOTORS CORPORATION
DAYTON 1, OHIO

A GENERAL MOTORS PRODUCT — A UNITED MOTORS LINE

DISTRIBUTED BY WHOLESALERS EVERYWHERE

DON'T MISS THE BOAT... enter Light's Diamond Jubilee lighting competition for electrical contractors...



...with one or more of the following types of lighting installations: Stores, Schools & Offices, Industrials, Residential, Floodlighting, Miscellaneous (hospitals, banks, lobbies, etc.)

- ★ **$1350 in cash awards**
- ★ **Publication of first prize winning entries**
- ★ **Free reprints of published first prize articles for local sales promotion**

ELECTRICAL CONSTRUCTION AND MAINTENANCE

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330 WEST 42nd STREET, NEW YORK 36, N. Y.

Lighting Competition Chairman
ELECTRICAL CONSTRUCTION AND MAINTENANCE
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Next Steps in Atomic Progress . . . A Challenge to American Industry

The purpose of this editorial is to throw light on the significance for American industry of recent changes in the statutes that control the development of atomic energy.

The need for clear light on the meaning of this new legislation is made more urgent by the political confusion and distortion that marked its course through Congress. The politically inspired charges of "giveaway" that delayed its passage — charges that were almost totally unrelated to the legislation itself — helped to obscure the vital importance of the step finally taken by Congress.

In sober, post-Congressional fact, the principal significance of the new atomic legislation is that it extends to private enterprise responsibility for the development of peaceful uses of atomic energy, whereas heretofore this responsibility has rested in a tight government monopoly. **And this extension is made on terms that emphasize the responsibility far more than they open any opportunity for economic gain in fulfilling it.** The revised Atomic Energy Act provides that:

1. Industry may now own and operate its own nuclear reactors, under license from the Atomic Energy Commission. And it may build and sell nuclear reactors for export.

2. Industry may use — but not own — nuclear materials at the discretion of the Atomic Energy Commission.

3. The Atomic Energy Commission will make available to industry scientific knowledge that may be useful in developing peaceful applications of nuclear energy.

4. For the first time, industry will have the right to patent inventions in the field of nonmilitary nuclear energy. However, "basic" discoveries must be made available to all companies in the field for a period of five years, after which they, too, will revert to normal patent status.

Two Kinds of Know-How

These provisions, despite the imposed limitations, represent the first positive step toward development of nuclear energy for peaceful applications in the United States. Potentially useful knowledge, previously locked in the minds of government scientists, will now be available to all those who are willing and able to put it to work for the good of mankind.

The advantages to be gained from enlisting the talents of American industry in the development of peaceful atomic applications are imposing. As *The* (London) *Economist*, Europe's leading economic journal, recently remarked, "The atomic scientists are in a position to surmise how atomic energy can be applied... but they lack the specialized knowledge of engineering design and operating technique just as industry itself lacks atomic knowledge." Now the engineers of private industry need no longer lack the atomic knowledge, and there is granted to them at least a restricted freedom to apply it to the solution of their engineering and operating problems.

But the new opportunity for private industry to find constructive uses for the science of nucleonics carries with it a grave responsibility. These uses must be so developed that they will benefit the people of all the free nations. It is essential that the United States, which pioneered in developing lethal uses for atomic fission, demonstrate to the world our paramount interest in its peaceful application. It would be a moral set-back to the free world almost beyond calculation if the Communists should be able to offer to the poorer nations of the world the benefit of low cost atomic power — provided by Communist technicians — while we concentrate primarily on building our stockpile of atomic and hydrogen bombs.

Race For a Peaceful Victory

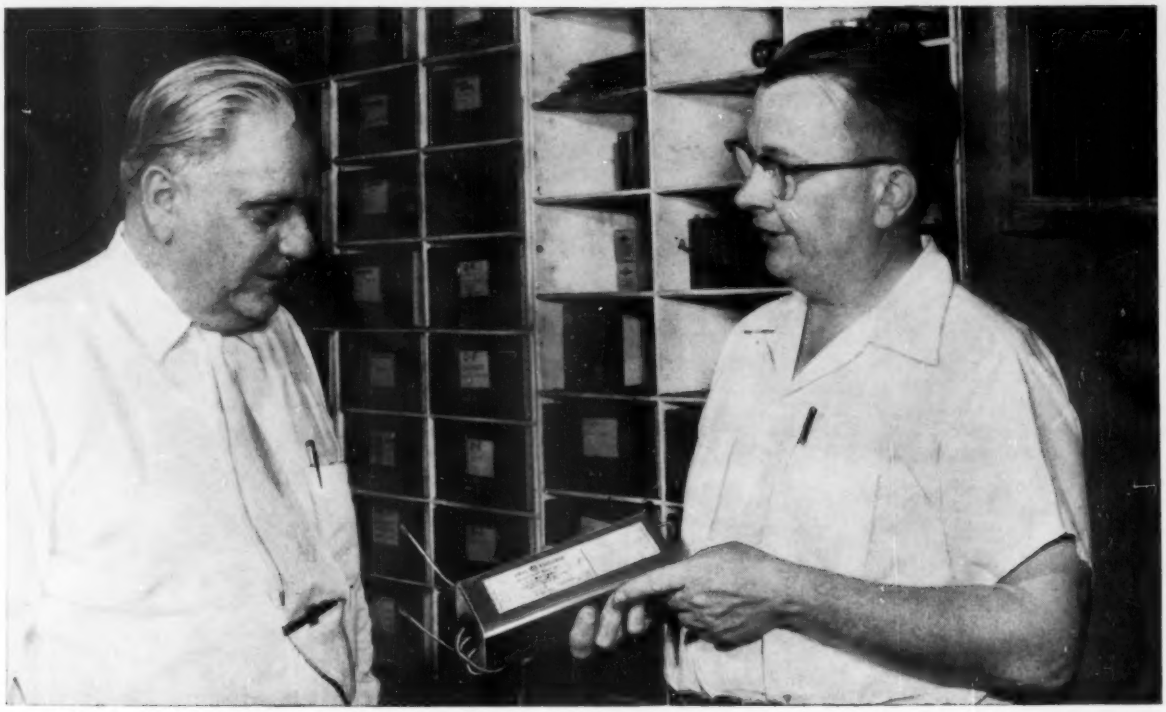
Most of the experts are agreed that it may be many years — perhaps ten, fifteen or more — before the cost of electricity from atomic fission can be reduced to a level that will make it competitive with conventionally produced power in most regions of the United States. But most of the world is not nearly so fortunate as we are in power resources. Electricity, even at a cost far higher than the average that prevails in the United States, would be a blessing in many countries, and the nation that provides the technology to bring it into being will score a great moral victory.

The useful potential of nuclear energy is not restricted to the generation of electric power — although twenty years from now this use will be highly important to the power industry of the United States. Even with the limited research that has been done in this field thus far, the use of radioisotopes — the radioactive products of atomic reactors — is saving American industry an estimated $100 million a year. Commissioner Campbell of the AEC, who made this estimate, believes that these savings may well reach $1 billion a year within ten years. Radioisotopes are already at work in industries ranging all the way from paper manufacturing, where they measure paper thickness, to pipeline transportation, where they mark the dividing lines between shipments of different products (at an estimated saving of $500,000 a year). Medical applications of these same radioisotopes hold promise of longer and more comfortable lives for those who are stricken by cancer and other diseases.

Above All a Challenge

The new Atomic Energy Act is a crucial stride toward the day when all these benefits — and undoubtedly others not yet revealed by research — will be realized. But it is a step that is essentially permissive. It still leaves it to private industry for the most part to decide what is to be done and how soon.

The new act is thus, above all, a challenge. It confers on private industry the responsibility to assume a leading role in the development of peaceful uses for nuclear energy, a step long urged by NUCLEONICS, a McGraw-Hill magazine devoted to atomic energy. To achieve a success in this task that will measure up to the requirement of the national interest, this development must command all the resources and ingenuity that private enterprise can apply — and do so without promise of glittering prizes surely to be won. **But now that the responsibility has been defined and the challenge offered, American industry will, we believe, measure up to its grave and mighty import.**



Harrisburg, Pa., Contractor says . . .

"I'm sold on G-E Ballasts — so are my customers!"

Mr. Charles E. Bashore, co-owner of the Edwin L. Heim Co., Harrisburg, Pa., has been serving important customers in the Harrisburg area for more than 20 years. When asked why he consistently uses G-E ballasts on fluorescent lighting jobs, he said:

"Ballasts are mighty important to a good lighting job so naturally I use the best I can get. In my opinion, that means G-E. There are a lot of things I like about G-E ballasts. For one thing, I know from experience they can be counted on to give long, dependable service. Another is that G.E. makes a full line of ballasts, and, they don't cost any more than other good ballasts.

"Those are a few reasons why I'm sold on G-E ballasts. But I'm not the only one—so are my customers!" Top quality control and modern manufacturing techniques account in part for the popularity of G-E ballasts with men who know the lighting business.

On your next job, be sure to specify General Electric ballasts. Your lighting equipment distributor should have them.

FREE! Mr. Contractor, we have for you one of the most useful publications ever prepared on ballasts. It's a cross-reference chart which tells you at a glance the catalog numbers of the right G-E ballast to replace ballasts of other manufacturers. It will make it easy for you to use G-E ballasts for replacement. Get your copy today —free, of course! Mail this coupon.

General Electric Co.
Section C401-12
Schenectady, N. Y.

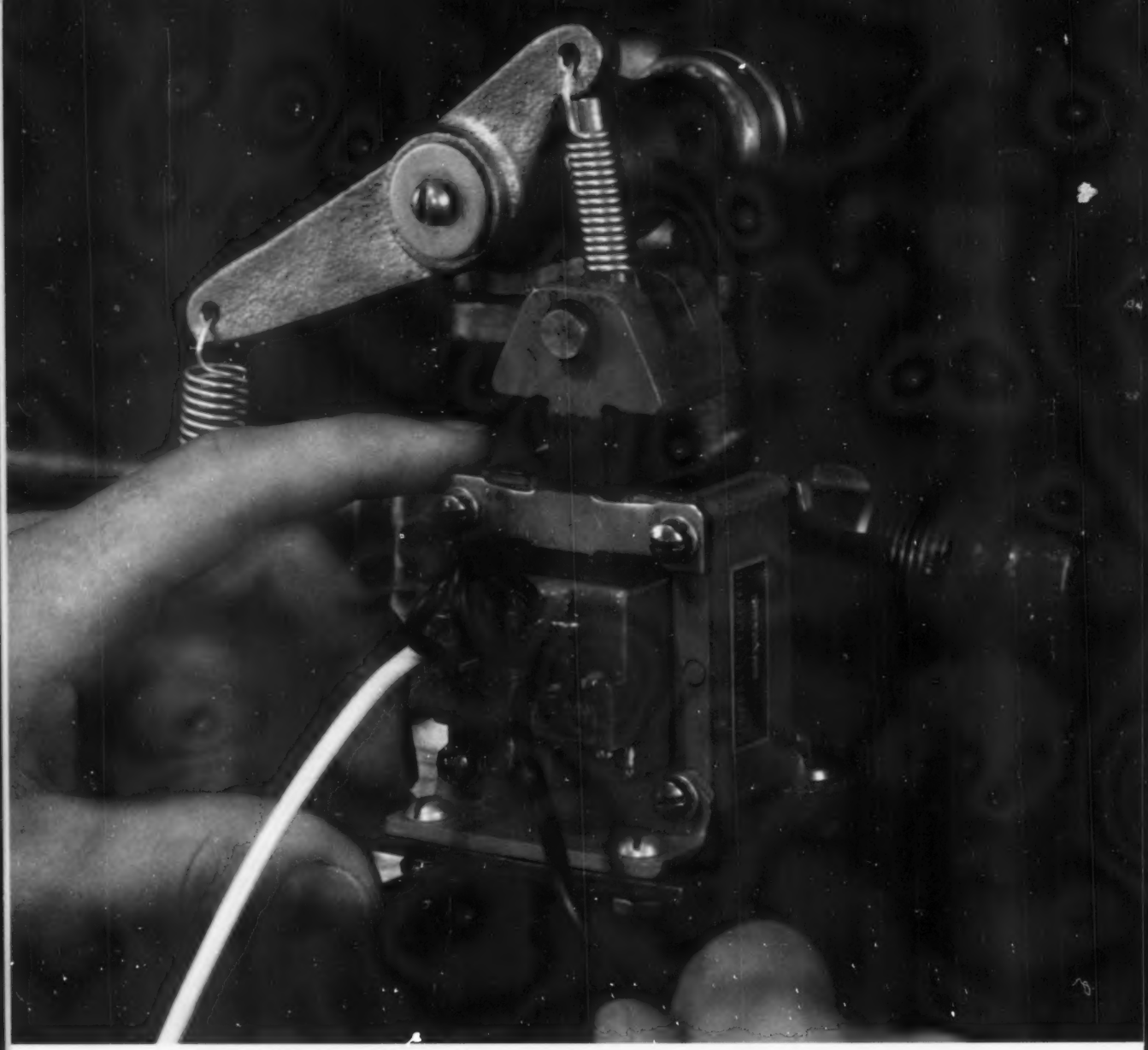
Send me a free copy of your cross-reference guide on Ballasts (GED-2416).

Name_____

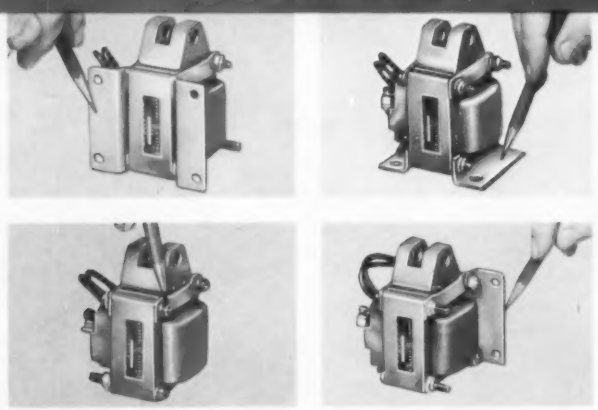
Address_____

City_____ **State**_____

GENERAL ELECTRIC

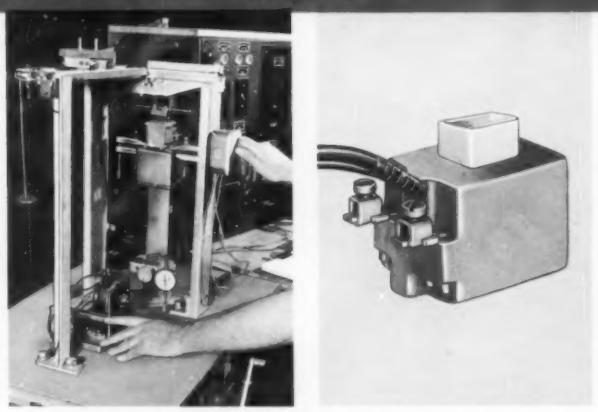


GREATER FLEXIBILITY



New General Electric solenoids mount in five positions — end, right- or left-side, throat, or with thru-bolts. Both leads and built-in terminal board on strongbox coils give added flexibility.

LONGER LIFE



Laboratory tests proved the new strongbox solenoid has much longer life. Long life results from design features such as strongbox coil, and double-strength, spring-steel mounting brackets.

G. E. ANNOUNCES

NEW STRONGBOX SOLENOIDS

The all-new line of General Electric industrial solenoids was designed to include the features you requested. From your requirements, design specifications for the new line were written — and here is the new, more economical solenoid you asked for.

GREATER FLEXIBILITY

New solenoids mount in five positions. Mounting brackets can be moved to any of the four sides, or thru-bolts can be used. Both leads and built-in terminal board on strongbox coils make either type wiring immediately available.

LONGER LIFE

New General Electric solenoids last longer because of new design components. Strongbox coils, enclosed layer wound Formex* windings, give long electrical life. New double-strength, spring-steel mounting brackets contribute to added life. New design also includes glass fabric plunger guide, and larger linkage-pin hole.

COMPLETE RATING COVERAGE

Complete coverage is supplied by nine ratings in each of the following forms (nominal ratings at maximum stroke).

3.0 to 40 lbs in ½ inch pull forms
1.4 to 36 lbs in 1 inch pull forms
2.0 to 33 lbs in ½ inch push forms
4.3 to 28 lbs in 1 inch push forms

Sizes are available in 60, 50 and 25 cycle, and d-c forms. Voltage ratings are from 24 to 600 volts.

SMALLER SIZE

22 percent smaller for the same power ratings, new General Electric solenoids will reduce space problems when mounting solenoids in your equipment. Smaller enclosures and reduced material costs make new solenoids more economical.

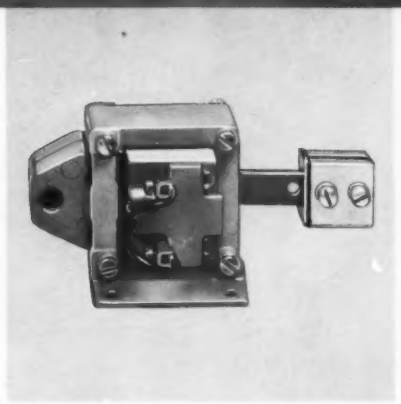
FOR MORE INFORMATION contact your nearest Apparatus Sales Office, or Distributor, or write Section 730-58, General Electric Company, Schenectady 5, N. Y. Ask for Bulletin GEA-6215.

*Reg. Trademark. General Electric Co.

Progress Is Our Most Important Product

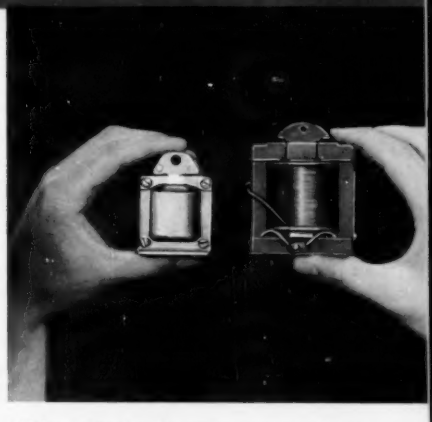
GENERAL ELECTRIC

COMPLETE RATING COVERAGE



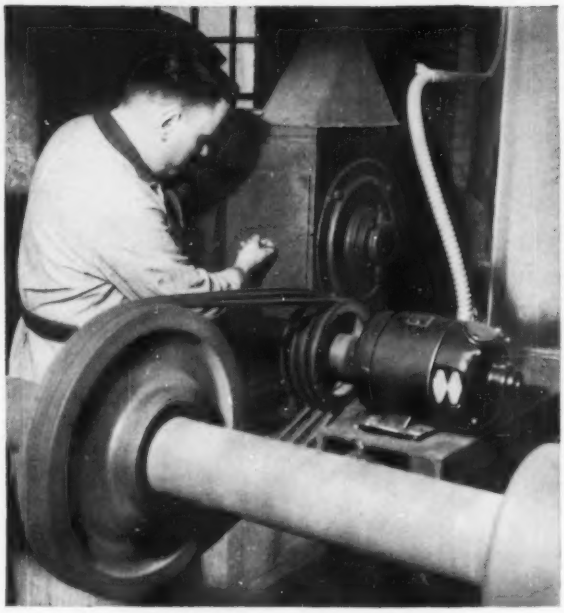
Supplied by nine force ratings in each of the forms, new strongbox solenoids are available in both push and pull forms, at one-half and one inch strokes. All these sizes are available in d-c, 25, 50, and 60 cycle a-c, with voltage ratings from 24 to 600 volts.

SMALLER SIZE



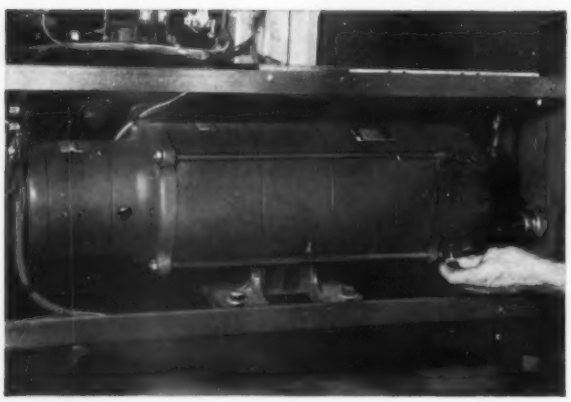
22% smaller for the same power ratings, new General Electric solenoids will reduce space problems in your equipment.

1 INCREASE EQUIPMENT FLEXIBILITY. G-E d-c fhp motors are excellent for machines that require variable speed to meet changing requirements. Here, blade speed is adjusted depending on hardness of metal being cut.



2 IMPROVE PRODUCT QUALITY. G-E tachometer generators accurately measure rotational and linear speed on equipment such as processing machines and conveyors where product quality depends on precise speed control.

Save 3 ways with G-E d-c equipment



3 SIMPLIFY PROCESS CONTROL. G-E amplidynes are simple and compact, yet provide fast, accurate control of current, voltage, speed, tension, or position. They're used on a variety of process equipment plus machine tools.

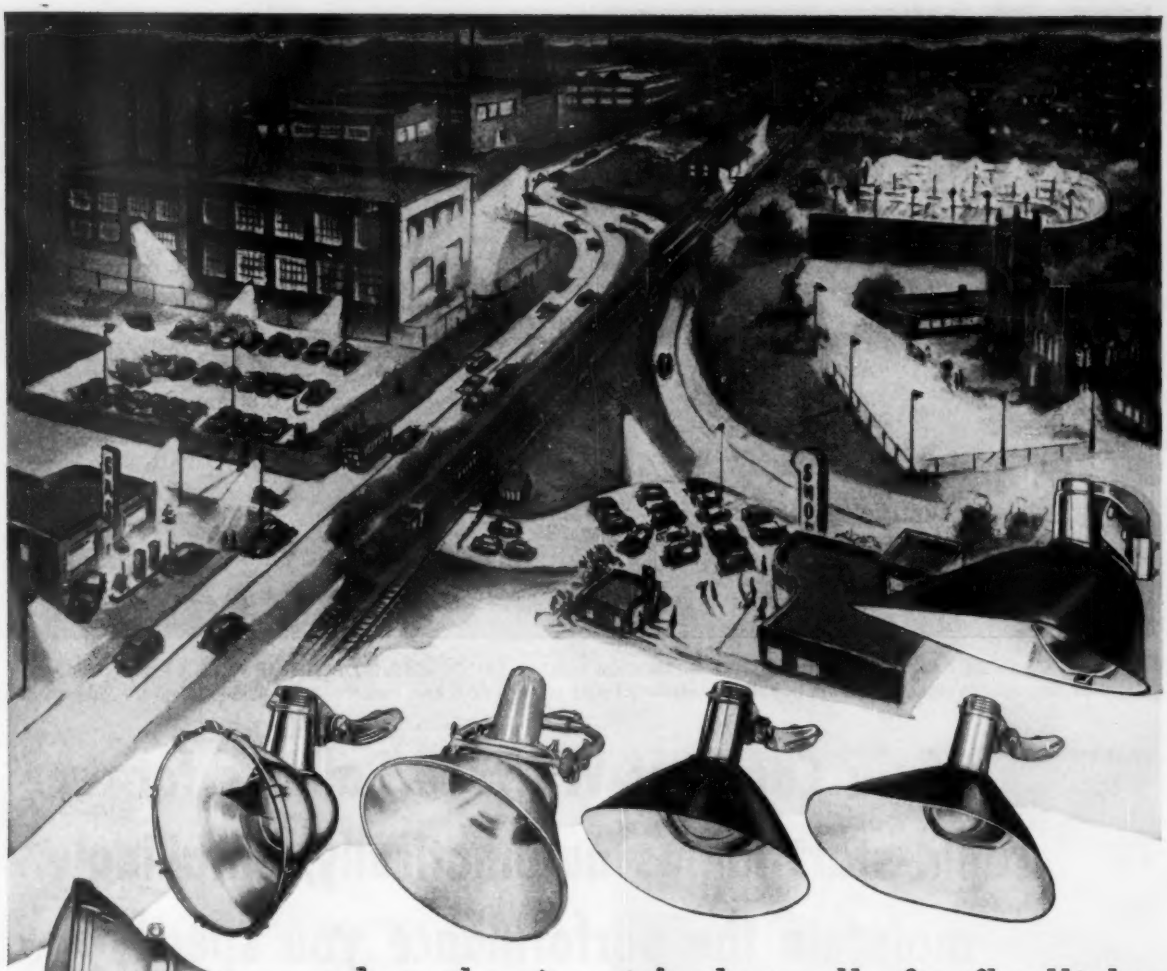
General Electric's small d-c equipment helps step up production, improve product quality, make machinery more flexible

Today's production machines demand flexible control of speed, torque, acceleration, and deceleration . . . flexibility that only d-c equipment can provide. That's why one out of ten industrial machines is now d-c powered.

GENERAL ELECTRIC APPLICATION ENGINEERS stand ready to help you take advantage of the benefits of d-c equipment and to assist you in the selection of d-c motors and equipment best suited for your needs. To arrange for this help . . . and for additional information on d-c equipment as shown . . . contact your local G-E Apparatus Sales Office or Distributor today. Or write General Electric Company, Section 704-13, Schenectady, N. Y.

Progress Is Our Most Important Product

GENERAL ELECTRIC



when there's a job that calls for floodlights . . . there's a *BENJAMIN FLOODLIGHT* to do it BETTER!

Whatever your floodlighting requirements, you can rely on Benjamin equipment to do a better job. *"Doing it better"* has been the objective of Benjamin Engineering for over half-a-century. Through the years, Benjamin has pioneered in the use of floodlights in all applications . . . to beautify industrial exteriors . . . to correctly light sports areas . . . to speed up construction . . . to beckon more customers into service stations . . . to facilitate parking for park-and-shop projects, etc. You draw on this vast engineering experience when you specify Benjamin.

That's why you'll find, whatever the floodlighting job, Benjamin Floodlights are time-tested and designed to do it better. They're engineered to deliver sustained performance and original high light output despite continuous exposure to all kinds of weather. Genuine "Life-Time" Porcelain Enamel and "Alzak" Aluminum reflectors simplify upkeep and cleaning of reflecting surfaces. To simplify operation and maintenance, Benjamin Floodlights feature such famous Benjamin engineering refinements as: "Saflox" Floodlight Lowering Devices, patented detachable hood assemblies, convenient pre-setting arrangements and a wider range of brackets and fittings to meet every mounting requirement. Further, every Benjamin Floodlight is specifically designed to meet the requirements of the outside-seeing task with proper shielding, correct light distribution, maximum protection glare and wide range of beam spreads. We will be glad to send you detailed Data Bulletins on any one or all of the floodlights illustrated here. Write Benjamin Electric Mfg. Co., Dept. H, Des Plaines, Ill.

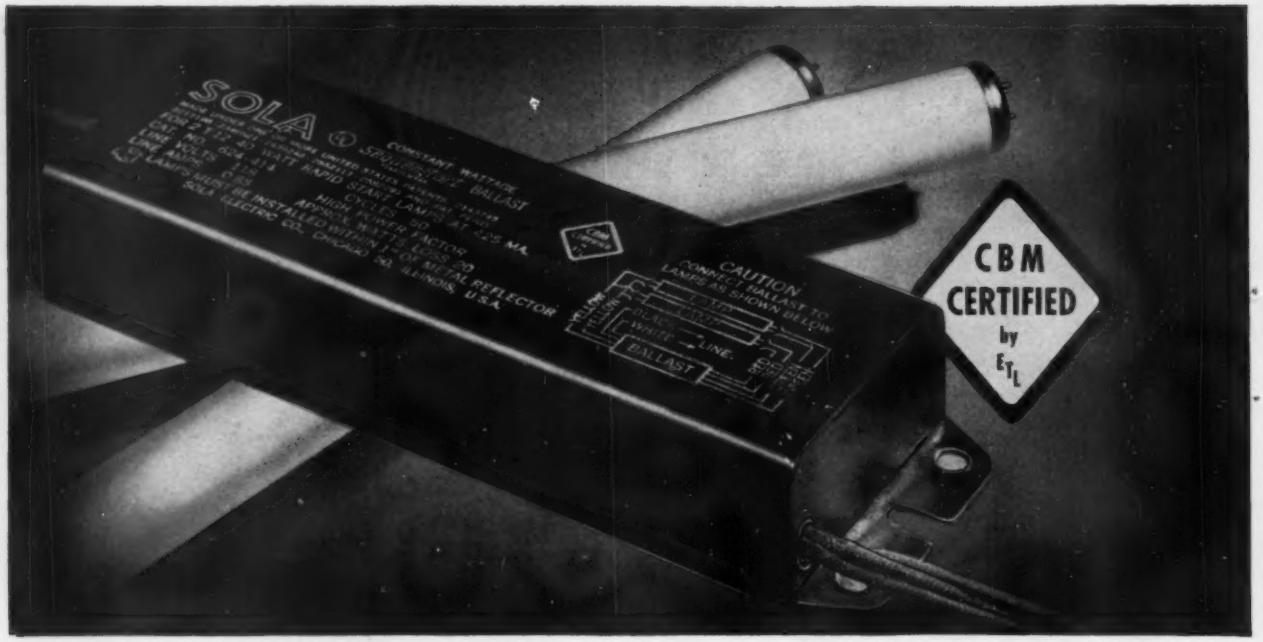
Here are 8 Benjamin Floodlights that do the job BETTER! (reading from top to bottom:)

- "Duo-Service" Floodlight
- "Senior Play-Area" Floodlight
- "Ellipto-Lite Play-Area" Floodlight
- "Olympia" Floodlight
- "Alzo-Lite" Floodlight
- "RD" Floodlighting Projectors
- "Utility" Floodlight
- "Cluster-ettes"

BENJAMIN TRADE MARK

Floodlights

Sold exclusively through electrical distributors. B-387J



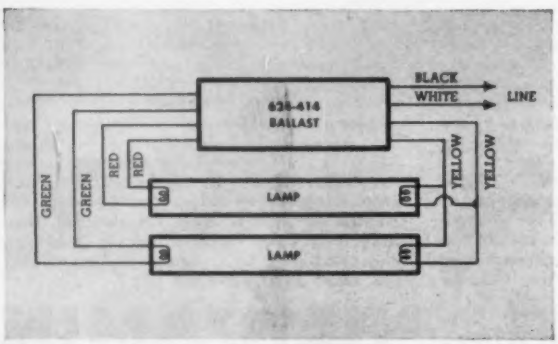
LOW, COMPACT RAPID-START BALLAST CASE: Case height 1-13/16", width 3-1/8", length 8-5/16". Fits all standard rapid-start channels. Weighs only 5-3/4 pounds. Leads are clearly color-coded, and long enough for easy hook-up without splicing.

Sola Constant Wattage Ballasts for rapid-start lamps automatically, unfailingly maintain the performance you specify

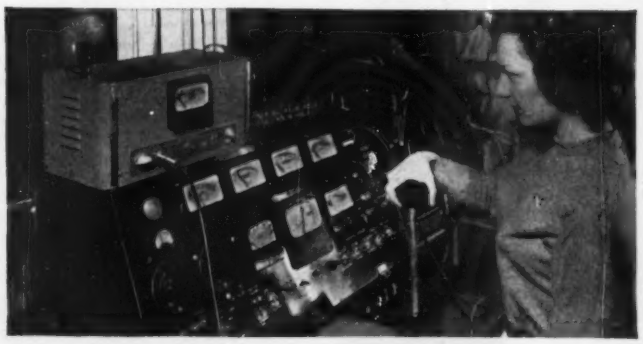
The rapid-start fluorescent lamp and the Sola Constant Wattage Ballast form the heart of a nearly perfect lighting system. When incorporated by the fixture manufacturer into a finished luminaire, you enjoy the advantages of instant-start with the economy of pre-heat fluorescent lighting.

The following five distinct points of superiority of the Sola constant wattage circuit make Sola ballasts particularly well suited for operation of rapid-start lamps.

1. LONGER LAMP LIFE: Lamp life is inversely proportional to the peak/rms ratio of the lamp's current



SIMPLIFIED FIXTURE INSTALLATION: Only two wires, directly from ballast, to connect on line — no wiring from line to lamp holders. The double wound circuit of the Sola Constant Wattage Ballast is self protecting against shock hazard for absolute safety.



EVERY BALLAST TESTED FOR LOW NOISE LEVEL: Sola ballasts are individually checked with a crystal sound probe to insure low hum level before release. Being a magnetic device, every transformer has some hum; however, good design and construction results in quiet Sola ballasts.

wave shape. Sola ballasts' peak/rms ratio is approximately 1.5 @ 118v — extremely low with good wave shape.

2. RELIABLE STARTING: The higher the voltage from lamp electrode to grounded fixture (an important starting aid) the more positive the starting. Sola ballasts provide 300v across lamp-to-ground with perfect safety — approximately 60% more than conventional autotransformer types.

3. CONSTANT LIGHT OUTPUT: Lumen output held constant to within ±2% over a primary range of 106-130v—you get all the light you paid for regardless of line voltage fluctuations as great as 20%.

4. QUIET OPERATION: Progressive compound pouring, special lamination design and pressed-in core-and-coil construction minimize lamination hum —ballasts are suitable for quiet area installations.

5. LONG BALLAST LIFE: Temperature rise is low under normal operation. When one or both lamps fail or rectify, ballast operating temperature is reduced, not increased—result is low ballast maintenance cost.

If you manufacture fixtures, or if you specify, operate or maintain lighting installations, investigate the advantages of a Sola Constant Wattage Ballasted rapid-start system. Write for full information, or request a Sola sales engineer to call with all the facts.

CBM CERTIFIED by ETL

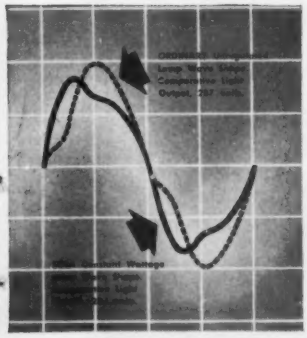
SOLA ELECTRIC CO.
4633 W. 16th St., Chicago 50
Phone Bishop 2-1414.
Representatives in principal cities.

WRITE FOR BULLETIN 17K-FL-199

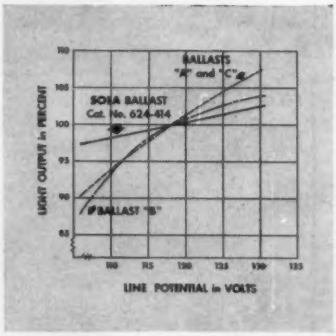
SOLA *Constant Wattage* BALLASTS

67,560 STARTS ON SOLA BALLASTED LAMPS: Sola Constant Wattage Ballast and other leading ballasts compared on accelerated-start life test of rapid-start lamps. Sola ballasted lamps averaged 19% more starts before lamps failed.

60% MORE STARTING VOLTAGE: Patented Sola ballasts provide 300v from lamp to starting aid for positive starting (conventional autotransformer types only 180v). U.L. listed. Completely safe due to Sola's isolated secondary circuit design. Lamps start even under adverse conditions of temperature, humidity and lamp life.



LAMP CURRENT WAVE SHAPE: Sola "CW" tested 16.7% lower peak/rms ratio @ 118v than ordinary ballast.



±2% LUMEN REGULATION: Stable light output of Sola "CW" ballast compared with three typical non-regulating units, each operating two T-12, 40w rapid-start lamps.

PRODUCTION LINE TESTING FOR REGULATING ACTION: Sola Constant Wattage Rapid-Start Ballast tested by varying primary voltage from 106-130v. Light output must hold constant within ±2%. This is one of many tests made to insure specified performance.

For easier application...

New *Quinterra*® and Quinorgo® Composites provide high mechanical strength

Samples of these Johns-Manville purified asbestos electrical insulations now available for testing by manufacturers and motor repair shops

Quinterra Type 3-GR is a Class H electrical insulation, good for operating temperatures up to 250C. It is constructed of a silicone-saturated purified asbestos sheet with a backing of smooth, tightly woven glass cloth. Type 3-GR combines exceptional tensile and tear strength with the highest humidity and pyrolysis resistance of any asbestos type insulation.

Quinterra Type 5-GR and Type 5-GL are premium quality Class B purified asbestos electrical insulations treated to resist operating temperatures up to 150C. Both have exceptional tensile and tear strength, with lasting dielectric strength. Type 5-GR (duplex) is one sheet of Type 5 bonded to one sheet of glass cloth, Type 5-GL (triplex) is one sheet of glass cloth between two sheets of Type 5.

Quinorgo No. 4000-GR and No. 4000-GL are economical Class B purified asbestos electrical insulations with exceptional tensile and tear strength and thermal stability. No. 4000-GR (duplex) is glass cloth backed with Quinorgo 4000. No. 4000-GL (triplex) is one sheet of glass cloth between two sheets of Quinorgo 4000. Both are untreated and readily absorb commercial insulating varnishes.

SAMPLES OFFERED WITHOUT CHARGE

These sample folders with description of the electrical and physical properties of Quinterra and Quinorgo composites are available from your insulation distributor. Or write Johns-Manville on your company letterhead indicating which type or types you desire. Address Johns-Manville, Box 60, New York 16, N. Y.; In Canada, 199 Bay St., Toronto 1, Ontario.

Johns-Manville ELECTRICAL INSULATIONS

KILLARK

ALUMINUM DIE-CAST CONDUIT FITTINGS

KILLARK = *Quality*

ALUMINUM = *No Rust*

DIE-CAST = *Accuracy*

COMPLETE LINE
OVER 40 YEARS EXPERIENCE
STOCKS IN MAJOR CITIES

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ELECTRIC MANUFACTURING COMPANY

Vandeventer and Easton Aves. **St. Louis 13, Missouri**

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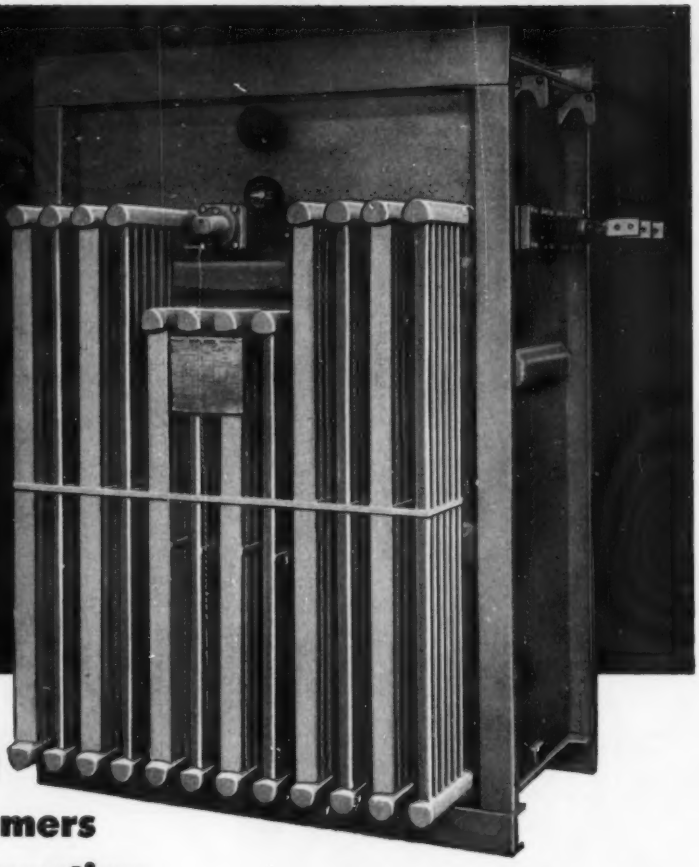
	CHICAGO	1528 West Adams St.	LOS ANGELES	412 Seaton St.	SEATTLE	4130 First Ave., S. W.
SALES OFFICES	BALTIMORE	11 W. 25th St.	COLUMBUS	2700 E. Main St.	MINNEAPOLIS	826 Andrus Bldg.
	CINCINNATI	49 Central Ave.	KANSAS CITY, MO.	616 W. 26th St.	NEW YORK	600 W. 181st St.

Wagner®
TRANSFORMERS
...the choice of leaders in industry

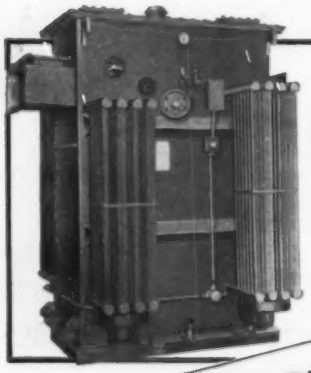
first step to building a compact, modern Unit Substation



THE NEW

Wagner Liquid-Filled Load Center Transformers designed for flush mounting

Now, Wagner Noflamol (non-inflammable liquid-filled) Load Center Transformers are available in a new, improved close-coupled design, as well as in the standard throat-connected design. These transformers can be flush-mounted with any make of switchgear to form a neat, compact, streamlined unit substation for modern industrial service.



Wagner
Throat-Connected Unit Substation Transformers

For outdoor installation, or for applications where it is desirable to locate the transformer away from the switchgear, Wagner can furnish these liquid-filled transformers in ratings to 2000 kva, 15 kv and below. Bulletin TU-13 gives full information.

Wagner close-coupled transformers are available in ratings from 500 through 2000 kva. They are carefully designed to meet your distribution requirements.

Look to Wagner for better transformers that assure a continuous, dependable flow of power. Your nearby Wagner engineer will be glad to help you solve your load-center problems. Call the nearest of our 32 branch offices, or write us.

Wagner Electric Corporation EST. 1891

WAGNER ELECTRIC CORPORATION
6413 PLYMOUTH AVE., ST. LOUIS 14, MO., U.S.A.

BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

ELECTRIC MOTORS
TRANSFORMERS
INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS—AIR AND HYDRAULIC

T54-11

NOT JUST *THIN*...NOT JUST *THINNER*... BUT THE WORLD'S *THINNEST* SHIELDED LUMINAIRE

NEW

2 5/8" THIN

THR 440—49" long, 26¾" wide, 2⅝" thin. Four 48" Rapid Start lamps.

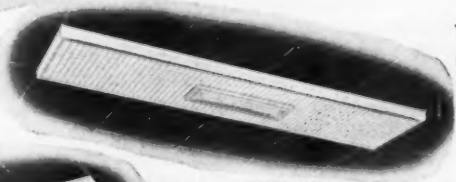
LPI *Thin-Lite*

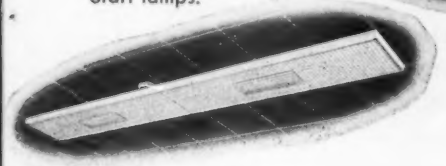
THS 496

97" long, 26¾" wide, 2⅝" thin. Four 96" 430 MA. lamps.

THR 240

49" long, 12¼" wide, 2⅝" thin. Two 48" Rapid Start lamps.





THS 296

97" long, 12¼" wide, 2⅝" thin. Two 96" 430 MA. lamps.

The fundamental concept behind the Thin-Lite series is the creation of a semi-recessed effect by means of an extremely shallow surface mounted fixture (an unbelievable 2⅝" thin). Imagine—the depth below ceiling is essentially the same as troffers fitted with dished shields.

Thin-Lite luminaires can be mounted end to end or side by side to form any desired lighting pattern. From every viewpoint—appearance, economy, ease of installation and maintenance—Thin-Lite by LPI is a born leader.

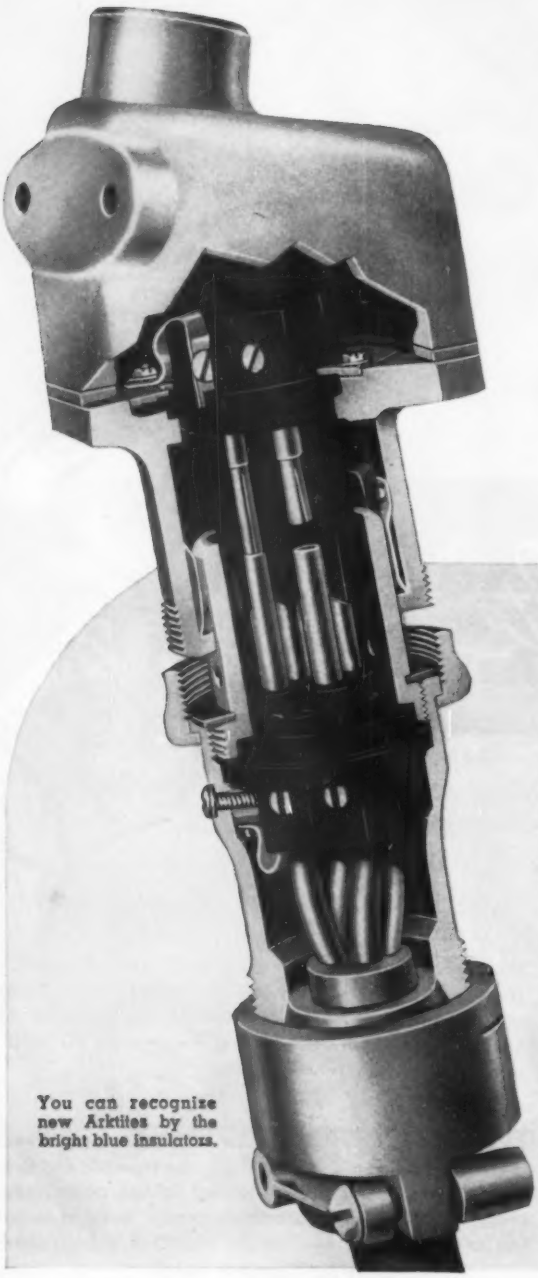
Write for Complete Details

5369

LIGHTING PRODUCTS INC., Dept. 4B HIGHLAND PARK, ILLINOIS

Announcing...

New, Re-Designed Arktite HEAVY DUTY PLUGS & RECEPTACLES



You can recognize new Arktites by the bright blue insulators.

New pressure connectors; no soldering unless you prefer to do it.

New easier-to-wire interior assembly; comes out in one piece—just remove 2 screws.

New easier-to-reverse plugs and receptacles; no machining; no special tools.

New plug adaptability; takes any size portable cable up to full 30 amp. capacity.

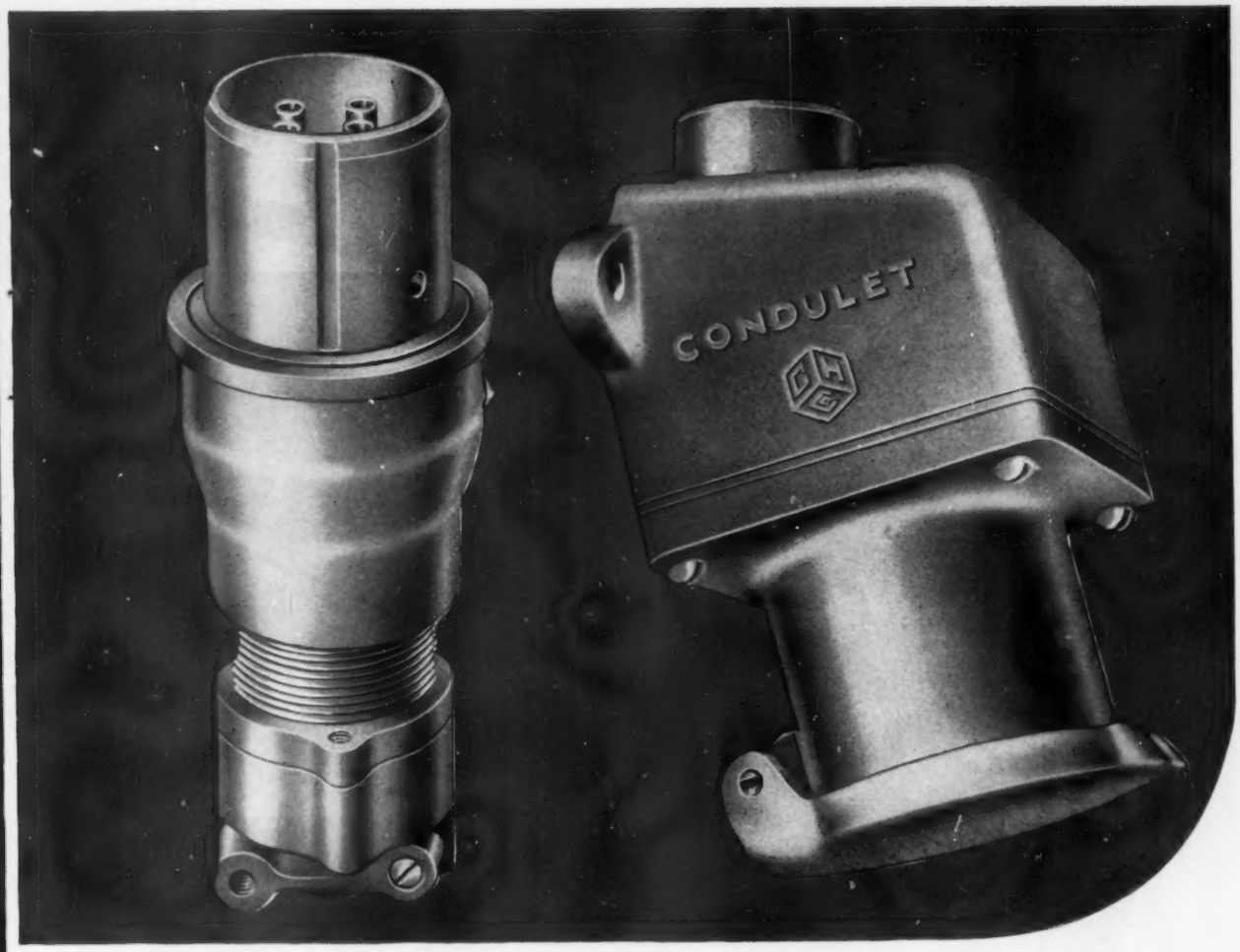
Circuit-Breaking Features make Arktite safe at full load without disconnect switches

Arktite's principle of insulating each contact in a separate chamber has been recognized for 20 years as the *safe* way to snuff the arc in making or breaking a circuit. Momentary arcs are formed or broken while the plug contact is still inside the arcing chamber. Flashover to the other side of the circuit or to the housing cannot occur even if the break is made at full load.

Grounding contact made first; broken last: *Arktite's* grounding contacts are longer than the load contacts. Plug and tool are grounded *before* the circuit is made and *after* it is broken.

Arc snuffed by pressure and lack of oxygen: Each plug fits so closely in the opening of its individual arcing chamber that arcs are snuffed by pressure-deionization and lack of oxygen.

Cable Entrance Watertight: A clamping nut seals a rubber bushing tightly around the cable. No moisture can enter.



First Complete Re-Design in 20 Years...

yet fully interchangeable with older types

Arktite's basic design is so safe and practical that no change in the fundamentals has been found necessary in 20 years. New wiring ease . . . new flexibility in making either the plug or receptacle the power side . . . and new adaptability to varying portable cable sizes up to 30 amps. have dictated today's re-design.

Even so, the improved *Arktite* plugs and receptacles are fully interchangeable with older types, and *list at the same economical price.*

Currently available in only the 30 amp. size (to be followed soon by new 60 and 100 amp. sizes), today's improved *Arktites* are made with two distinct ground circuits. Style 2 (illustrated) has an extra grounding contact bonded to the housing and forming a parallel circuit with the plug sleeve and receptacle detent spring. This assures continuity of the grounding circuit under severe service. Style 1 relies upon contact of the plug sleeve with the detent to complete the safety circuit. The extra grounding conductor in the portable cable is bonded to the plug handle.

Two-pole, three-pole and four-pole styles.

Full details described in technical bulletin sent free on request. Or see your Crouse-Hinds distributors.

A NATIONWIDE DISTRIBUTION exclusively through ELECTRICAL DISTRIBUTORS

CROUSE-HINDS COMPANY

SYRACUSE 1, N.Y.

CONDULETS • FLOODLIGHTS • TRAFFIC SIGNALS • AIRPORT LIGHTING

B-M *Fittings*

ARE APPROVED AS CONCRETETIGHT

When setting E. M. T. in concrete you can make each job easier and more profitable by using Briegel All Steel Indenter Fittings that have UL approval as CONCRETE-TIGHT. Contractors the world over recognize their cost cutting qualities and the fact that they make each wiring job a better job. It is only natural that Briegel Fittings are the most widely used E. M. T. connectors and couplings.

Cross Section Showing Indentations.

All B-M Indenter Fittings are U. L. approved as Concrete-tight and for General Use. (File Card E 10863). Also comply with Federal Specifications W-F-406.

BRIEGEL METHOD TOOL CO.

GALVA, • ILLINOIS

Warehouse Stocks in Principal Cities for Immediate Delivery!

another outstanding FA TRADE MARK installation

NEW YMCA BUILDING AT TULSA, OKLAHOMA

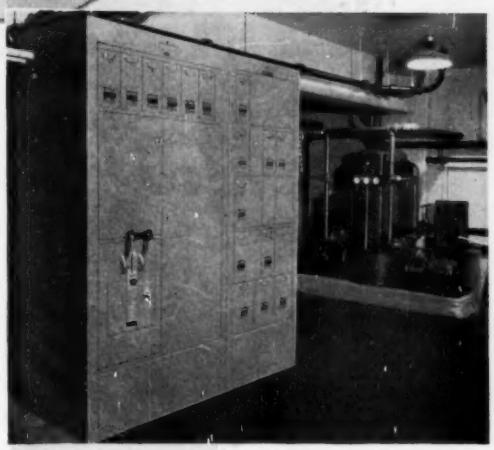
Reg E. Taylor, Houston, Tex., Engineer, and West Electrical Const. Co., Tulsa, Electrical Contractors. Leon B. Senter, Tulsa, Architect

The new and modern YMCA building in Tulsa, Okla., is the latest addition to the growing list of new and modernized buildings — commercial, industrial, institutional and residential — equipped with Ⓕⓐ products for the control and distribution of power and light.

Like so many others, officials of the Tulsa "Y" learned, after careful study, that Ⓕⓐ products were safe, dependable, long-lasting and trouble-free, and that they not only provide for present-day power needs, but allow for future expansion.

The next time you have a job involving power and light control, and distribution, recommend Ⓕⓐ products. You'll find that it pays.

For further information, consult our catalog in Sweet's or your nearest Ⓕⓐ representative.



Ⓕⓐ Switchboard installed in new Tulsa "Y". The complete line of Ⓕⓐ switchboards includes:
Ⓕⓐ SHUTLBRAK — 30 to 1200 amps., 250 volts AC or DC and 600 volts AC 2, 3 and 4 poles. Rotary type operating handles furnished on 30 to 200 amp. capacities. Straight handles on all others.
Ⓕⓐ KLAMPSWITCHFUZ AND SNUFARC — **Klampswitchfuz** capacities 30 to 600 amps., 250 volts AC or DC, 2, 3 and 4 poles, single or double throw. **Snufarc** 30 to 200 amps., 600 volts AC 2, 3 and 4 poles.
Ⓕⓐ CIRCUIT BREAKER — 15 to 600 amps., 250 volts AC or DC and 600 volts AC, 2 and 3 poles.
Air circuit breakers used for larger capacities.

Frank Adam Electric Co.
BOX 357, MAIN P. O. • ST. LOUIS 3, MO.

makers of:
busduct • panelboards • switchboards
service equipment • safety switches
load centers • Quikheter

A clean, neat, easy-to-handle

Service Entrance Cable

No longer do sticky, hard-to-handle, unsightly service cables need to be your problem.

The new Rome Service Entrance Cable is easy to handle, neat, clean . . . and not subject to "bleeding" so prevalent with many service cables.

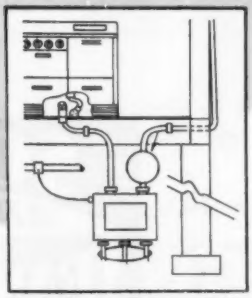
It Costs Less to Buy the Best

ROME CABLE
Corporation
ROME · NEW YORK
and
TORRANCE · CALIFORNIA

• NEW 45-minute sound color film "CABLE—PATHWAY OF POWER" now available for showings to technical personnel. For bookings, write to Rome Cable Corporation, Rome, N. Y.

Rome SE *has four advantages to offer:*

1. The outer glass-cotton braid is finished with compounds which give the cable a neat appearance . . . without sacrificing flame and moisture resistance. This finish has a neutral gray color that can be painted, if desired, to match the color of the building on which the cable is installed. It defies severe storage and service conditions without deteriorating and becoming sticky. The impregnation of the outer braid cannot bleed through this finish to make the cable unsightly.
2. The glass-cotton braid on each conductor—one red and one black—is clean, permanent, and provides easy conductor identification.
3. The insulation on each conductor is Underwriters' Laboratories approved as heat-resistant type RH for 75°C . . . moisture-resistant type RW for 60°C.
4. The combination of a clean interior and a clean exterior construction provides a neat flexible cable that is easier to handle and makes a better looking installation.



Rome Service Entrance Cable can be used from service drop to meter and from meter to electric range or water heater. It can also be used as a single cable directly from pole to meter.

Let us send you a sample of the new Rome Service Entrance Cable for your own examination. **Write today.**

The first cost of air-cooled transformers is not always the total final cost

1. *Because*

Some air-cooled dry-type transformers cost more to install than others.

1. *But*

SORGEL air-cooled dry-type transformers cost less to install because they are all self-contained in a single unit — either single phase or 3-phase — equipped with substantial wall brackets with slots for bolts, or with floor mounting base. No separate brackets to make or buy. Roomy connection compartment with wide choice of knockouts. Equipped with solderless terminal lugs, and permanent connection diagram.

2. *Because*

Some require a larger rating for a certain load.

2. *But*

SORGEL transformers do not require a larger rating than the load, because they are guaranteed to carry their full rated load continuously. They are so liberally designed that they can safely carry a temporary overload.

3. *Because*

Some must be installed in locations that require longer feeders and more expensive wiring.

3. *But*

SORGEL transformers are so quiet in operation that they can be installed in almost any convenient place inside of buildings, close to the load center. This results in shorter feeders, better voltage regulation, more efficient distribution, and lower wiring cost.

Complete Line

¼ Kva to 1500 Kva single phase.

1 Kva to 3000 Kva 3-phase, 2 phase, and phase changing.

All standard voltages, such as 120, 208, 240, 480, 600, 2400, 4160, 4800, 7200, 13,200, and up to 15,000 volts, and any intermediate or special lower voltage.

SORGEL
AIR-COOLED
Dry-Type
TRANSFORMERS

Stock carried by jobbers in the following cities:

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Davenport, Iowa
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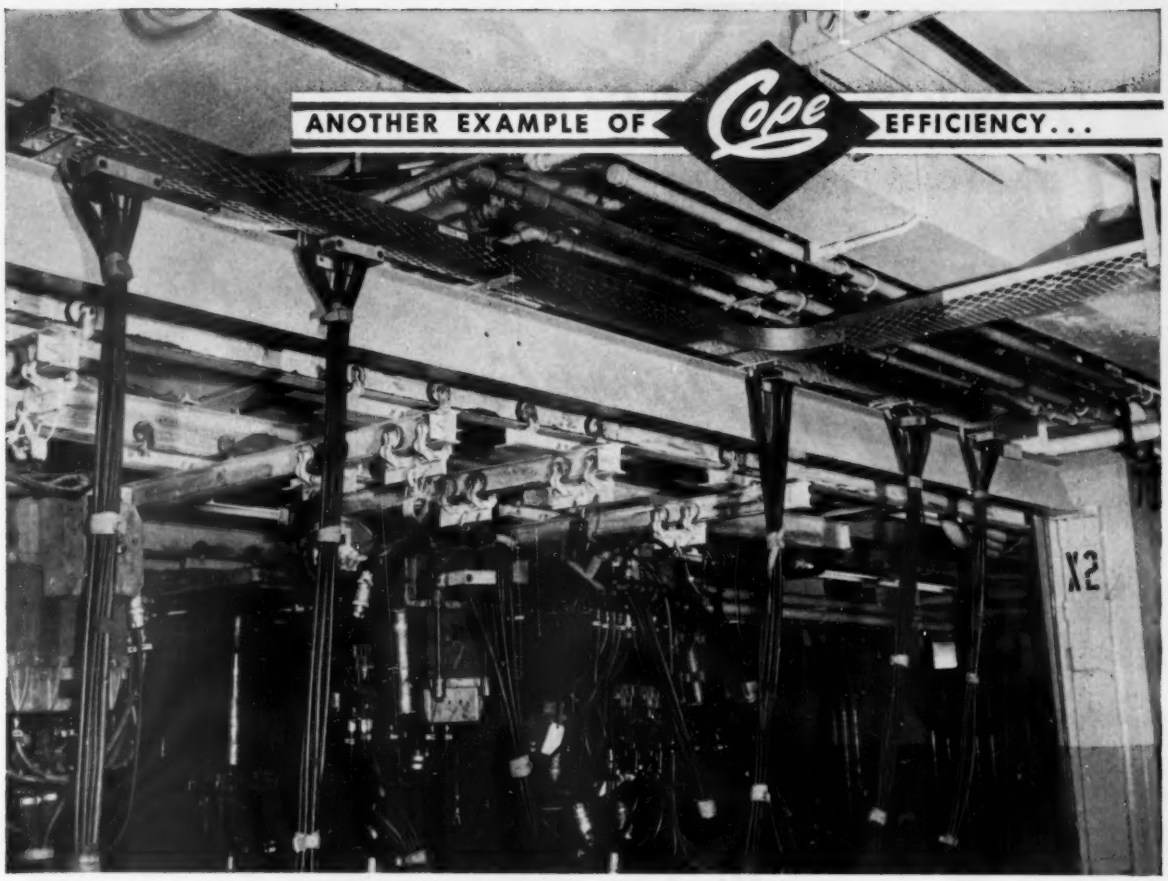
SORGEL ELECTRIC CO., 836 West National Ave., Milwaukee 4, Wisconsin

40 years' experience in the development, manufacturing, and application of Transformers



Cope Cable Trough installed at the Ford Motor Company, Dearborn, Mich.

COPE CABLE TROUGH—*VERSATILE, INDEED!*

The photograph above shows a run of Cope Cable Trough carrying not only power cables for the overhead electric welders, but tubing for the cooling water as well! It is an excellent example of the versatility of this method of power distribution.

The low cost and the ease with which Cope Cable Trough may be installed are making it extremely popular these days as a standard system for the support of power and control cables.

And that's not all . . . the trough is available in a wide range of sizes and fittings which permit it to be quickly set up at the job site to conform to almost any plant layout.

Why not find out more about Cope Cable Trough? Write today for further information . . . Ask for Bulletin 11-EC.

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Cope

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Maximum Flexibility for Endless Combinations to Meet Every Lighting Need with Minimum Stock Requirements!

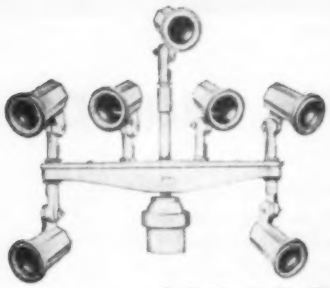
Eye-Appealing in Beauty... Budget-Appealing in Price!

LAMP HOLDERS AND ACCESSORIES

Cat. No. YL-50—Deluxe Yard-Light with vapor-proof fitting and globe.

SMART NEW DESIGN, CAST ALUMINUM, GLEAMING CHROME-LIKE FINISH • WEATHER RESISTANT • MINIMUM POROSITY CORROSION RESISTANT • NO MAINTENANCE

Higher Quality — Lower Cost!



Combination of No. 134 Trough, 7 No. 136 Lamp Socket Units. No. 138 2" Pipe Slip-Fitter, No. 190 4" Extension.

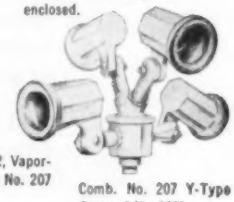
Cat. No. 175-B—All Metal Spotlight Holder complete with 6' cord, rubber plug. Furnished with separate weatherproof gasket, with spike.

Cat. No. 177—Y-Type Flange Splice Box.

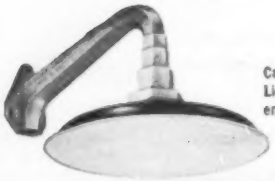
Cat. No. 137—Mogul Base Holder fully enclosed with 20" fixture wire.

Cat. No. 136—Lamp Holder for PAR-38 Bulb, wired with 20" fixture wire fully enclosed.

Cat. No. 230, 231, 232, Vapor-proof globe fittings; No. 207 Y Type acorn.



Comb. No. 207 Y-Type Acorn, 4 No. 136's.



Cat. No. YL-40—Deluxe Yard-Light with green and white enamel shade.

Cat. No. 144 — Curved Splice Box with removable cover.

Cat. No. 206—Acorn Splice Box with removable lid.

Cat. No. 120—for PAR-38 or GE-R40 200-watt low price completely enclosed wire unit.

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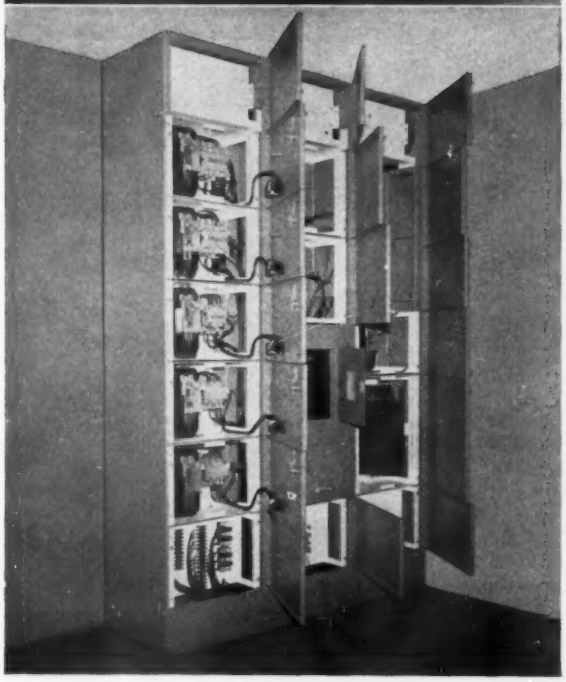

The Problem:
RUNNING A BIG PLANT WITH LIMITED PERSONNEL

A CITY FINDS The Answer:

ARROW•HART Control Centers

The City of Meriden, Connecticut was faced with the problem of running its new sewage disposal plant efficiently with limited personnel. An Arrow-Hart Control Center . . . laid out by John P. Legnos, Associates, consulting engineers on the job . . . helped to provide the answer. Magnetic controls for the sewerage and water seal pumps, recording meters that indicate the time the pumps have run, and controls for the unit heaters in the building are all combined in a single, compact A-H Control Center. Both operation and maintenance are handled easily and effectively.

A-H CONTROL CENTERS offer THESE IMPORTANT ADVANTAGES . . .

- **BIGGER SPACE SAVINGS** . . . up to 50% more than any other type, thanks to A-H "Advanced Design" Controls.
- **ADDED FLEXIBILITY** . . . much smaller A-H Controls permit rating increases up to 30 hp without increasing compartment size.
- **GREATER SAFETY** . . . with dead-front construction, all buses and wires completely enclosed; *plus* external handle mechanism that prevents door opening unless the disconnect is in the safe "OFF" position.
- **IMPROVED PERFORMANCE, DEPENDABILITY** . . . are assured by exclusive Arrow-Hart "Right Angle" Starter Design.
- **EASIER MAINTENANCE** . . . all controls are grouped in a single location. Each Control Unit offers Straight-Thru Wiring with all parts easily accessible from the front.

WRITE NOW FOR COMPLETE INFORMATION . . . SEE HOW ARROW-HART CONTROL CENTERS CAN HELP YOU FIND THE SIMPLE ANSWER TO YOUR COMPLEX CONTROL PROBLEMS.

SINCE 1890

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INDUSTRIAL CONTROL DIVISION
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Offices, sales engineers and warehouses in: Atlanta, Boston, Buffalo, Chicago, Cincinnati, Cleveland, Dallas, Detroit, Houston, Indianapolis, Los Angeles, Milwaukee, Minneapolis, New York, Philadelphia, Pittsburgh, St. Louis, San Francisco. In Canada: Arrow-Hart & Hegeman (Canada) Ltd., Mt. Dennis, Toronto. In England: Arrow Electric Switches, Ltd., Ealing, London W5.

Quality MOTOR CONTROLS • WIRING DEVICES ENCLOSED SWITCHES • APPLIANCE SWITCHES

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Please send my free copy of Folder CC-44 that includes complete information on Arrow-Hart Control Centers.

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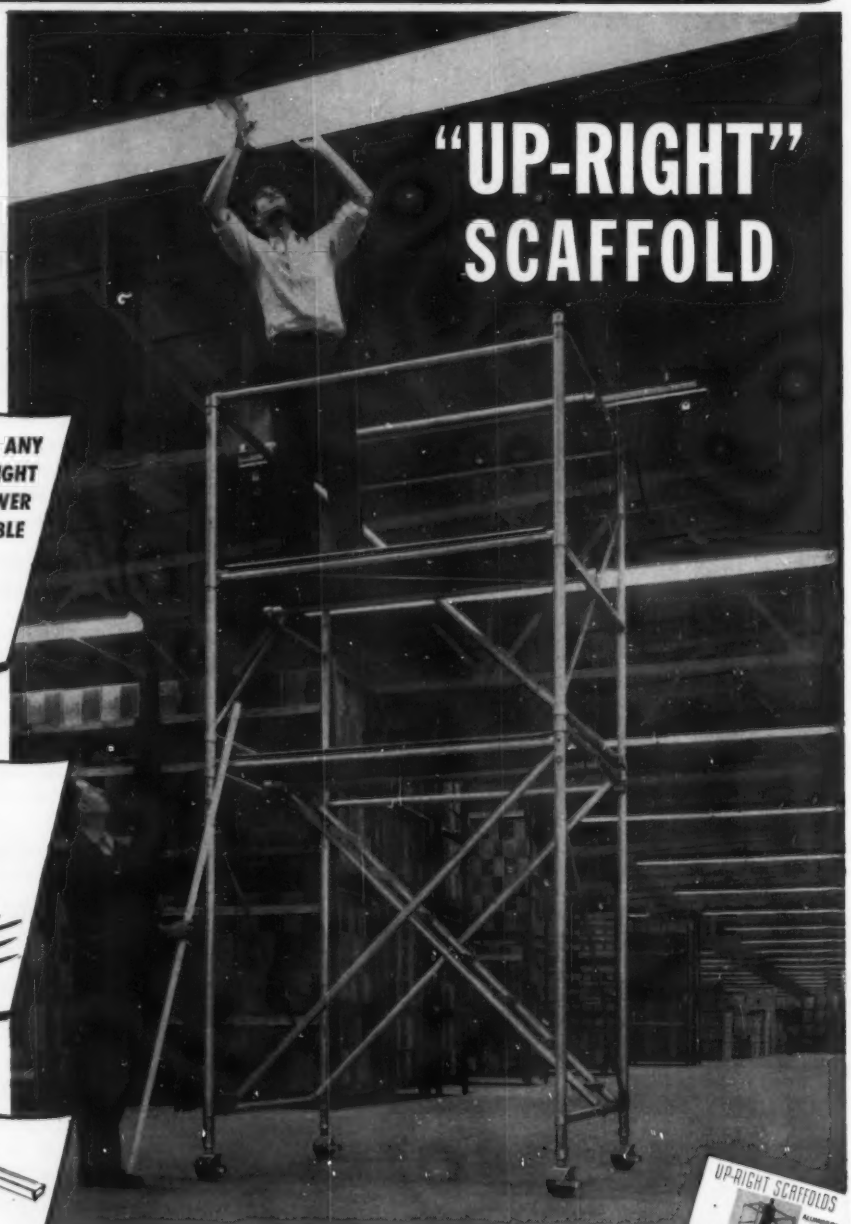
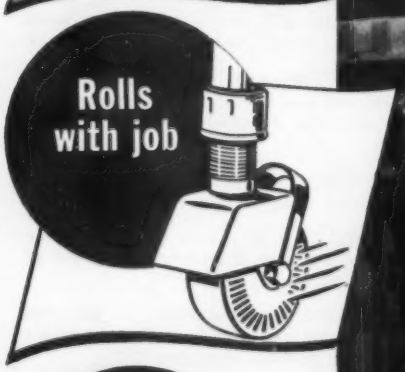
ECM

WALTER D. VANCE, JR., *Vice President* • *California Electric Co., reports:*

"We saved 14 days installing 527 fixtures by using 'UP-RIGHT' Scaffold-on-Wheels"

Man-hour savings on this General Motors warehouse job amounted to over 40%. Up-Right Scaffold is so light it is easily assembled by one man. Individual 1 piece aluminum alloy sections are unfolded and set one on top of the other. They lock into place instantly.





Write for descriptive circular ➡

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Dept. 159 • 1013 Pardee Street • Berkeley, California

Factories: Berkeley, Calif. and Teterboro, N. J. • Offices in all principal cities

BULLDOG UNIT-VERSAL SWITCHBOARD

Switch units in the Unit-Versal Switchboard use BullDog's exclusive Vacu-Break arcing chamber that prevents dangerous arcs, and the patented Clampmatic Contacts that hold tight as a bolted connection. Interchangeable switches and circuit breakers available in sizes from 15 to 600 amperes.

always room for one more

Provide the performance and protection needed *today*, the flexibility needed *tomorrow*, in one compact, low-cost switchboard. BullDog Unit-Versal Vacu-Break Switchboards are engineered to exact specifications—adapt or expand swiftly to fit changing power requirements.

Only a screw driver and a crescent wrench are needed to assemble, install, extend or convert these modern switchboards. Removable front plates (shown above) provide quick access to wire gutters; louver plates permit bus bars to be extended and connected easily.

BullDog's famous Vacu-Break Switch Units provide extra-safe "quick-make, quick-break" protection. Furthermore, ample space can be provided for additional switches, breakers, meters, transformers, motor controls or any other special equipment that may be needed.

Get complete details on this amazing switchboard. Write BullDog Electric Products Company, Detroit 32, Michigan. *Export Division:* 13 E. 40th Street, New York 16, New York; *In Canada:* BullDog Electric Products Co. (Canada) Ltd., 80 Clayson Road, Toronto 15, Ontario. ©BEPCO

A Division of I-T-E Circuit Breaker Company

THOROUGHBRED IN ELECTRICAL EQUIPMENT

BULLDOG ELECTRIC PRODUCTS COMPANY

dependable McGILL® lamp guards outlast all others

Here are two of the many McGill portable lamp guards that will withstand the hard wear and abuse of heavy industrial use. McGill 7000 and 650 series lamp guards last many times longer than ordinary guards because of exclusive design, heavier and better quality material and superior workmanship.

These models have pliable molded rubber handles and extra heavy steel wire cages that are electrically welded for strength and zinc plated with chrome finish to remain clean and bright for years. Sockets are 660 watt 250 volt, either plain or waterproof.

Such extras as cord seals, larger hooks and No-Rol ears to prevent cage rolling add to the safety and convenience of using dependable McGill portable lamp guards.

Model 7000-SR with Rubber Handle, Reflector and Levolier Switch.

Model 650-SR with Curved Rubber Handle. This exclusive handle design permits hanging portable cage down so that light is free from any possible handle obstruction.

all are McGILL quality

Model 5000-SR
Convenience Outlet, Reflector and Switch.

Model 5025-SLRG
Grounded Concentrating Lens.

Model 3006
Vaporproof Guard.

Model 5500-SRG
Grounded, No Outlet, Closed End Cage.

Send for the new McGill Catalog No. 49-A describing the complete line of McGill Lamp Guards, Sockets and Switches.

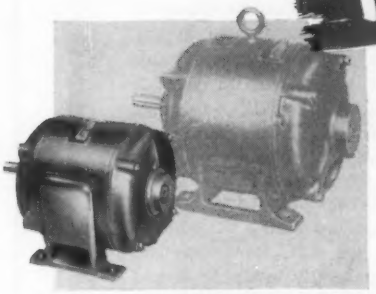
McGILL MANUFACTURING COMPANY, INC.
450 N. Campbell St., Valparaiso, Indiana

McGILL®
electrical specialties

NEW Century Performance-Rated® INTEGRAL H.P. MOTORS

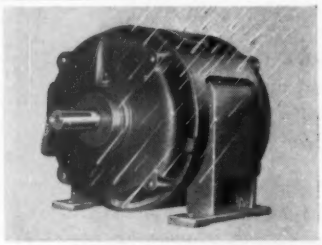
Now available in
1 . . . 1½ . . . 2 H.P. sizes—
NEMA frames 182 and 184.

Improved Motors to match your needs



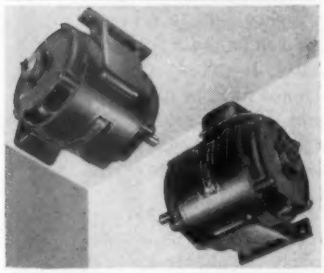
SMALLER — LIGHTER

More uniform silicon-laminated steel; thinner, *tougher* "Mylar" slot insulation — just two of the many technical developments that help make these new Century Performance Rated Motors so much *smaller* and *lighter*.



BETTER PROTECTION

New concepts of internal motor ventilation permit end bracket and frame design that gives far better protection from falling liquids and solids . . . still maintain 40°C. temperature rise.



MORE FLEXIBLE MOUNTING

You can even have cushion mounting with these new Century Integral H.P. Motors — your choice of sleeve or ball bearings. Ball bearing motors mount vertically, upside down, in any position. End brackets can be rotated for floor, ceiling or side wall mounting.

EVEN MORE DEPENDABILITY

Improved plastic impregnating varnish and plastic insulated magnet wire provide unusual resistance to abrasion, moisture and heat. These new materials possess far better dielectric qualities. Die cast aluminum rotors are individually, dynamically balanced to assure freedom from vibration.

885

Century C MOTORS

Specify CENTURY Performance Rated motors for your equipment. Call a Century District Sales Office or your nearest Century Authorized Distributor.

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CENTURY ELECTRIC COMPANY • 1806 Pine Street • St. Louis 3, Missouri

The Reader AUDITED PAID ABC CIRCULATION *His Mark*

THE ABC SYMBOL, which appears at the head of this page, is your brand—the reader's brand—on this magazine. It stands for Audit Bureau of Circulations. It means that this magazine will stay in business only so long as it continues to serve its readers to their satisfaction.

That Bureau—known for short as ABC—is a voluntary, nonprofit, cooperative association founded in 1914 by a group of publishers, advertisers and advertising agencies who wanted to establish and maintain higher standards of publishing practices than then prevailed. Its primary and specific purpose was to set up yardsticks to appraise circulation values and to verify the claims of publishers as to their circulations. For the buyer of advertising space this provides an effective means to take some of the guesswork out of buying and to reconcile the conflicting claims of competing publishers. BUSINESS WEEK magazine has aptly described ABC as "the publisher's conscience—and cop."

BUT IN DOING that job, ABC performs another function of high importance to the readers of ABC member publications. It provides a constant pressure on the publishers to keep alive in their staffs a sense of primary responsibility to their readers. That is because the most simple and direct method of making a publication responsible to its readers is to place upon it a purchase price, whether by subscription or newsstand purchase. The right to purchase or to refrain from purchasing a publication gives to the reader and to no one else the power to pass effective judgment on the publisher's success in serving the reading public. Each paid publication will grow or languish, will prosper or fail, in proportion as it wins or loses the following of thousands or millions of readers. The readers, by their patronage, record their judgments as to whether the publisher and his publication are measuring up to their responsibility to them.

And that is where the ABC comes into the reader's picture. The newspaper or magazine that carries the ABC symbol on its masthead must in the first place be a paid circulation publication. Moreover, it must conform to the high standards set up by the Bureau as to terms of payment and accounting methods. And again it must open all of its books to the auditors of the Bureau on demand.

SINCE THE INFORMATION thus determined by thorough and impartial audit is periodically made public through the ABC statements and audit reports, it is constantly available to and universally used by advertisers who are considering the purchase of space in an ABC publication. These reports show the circulation trend, as verified and certified by ABC, and thus put the advertisers in a position to know whether or not the publisher is rendering satisfactory service to his readers.

Thus the publisher who submits his publication to the supervision and discipline of ABC affirms in the strongest possible manner that he recognizes his primary obligation is to his readers and that he owes his standing to a voluntary demand by those readers. It follows that the editors of ABC publications must be exceptionally alert to the desires of their readers and responsive to their needs, since any decline in circulation will soon show up in the ABC statements and audit reports.

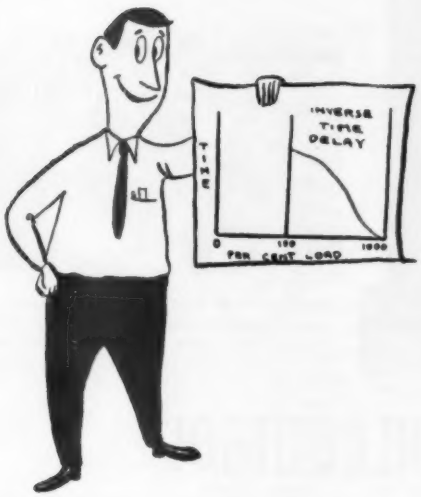
THAT IS WHY we describe the ABC symbol as the reader's brand. It shows that a publication must be primarily responsive to him and that he holds in his own hands its success or failure. And that ABC symbol is not only a constant reminder to him of that fact, but also an equally constant reminder to all concerned that the reader's willingness to pay for the ABC publication is the acid test of its value to him and to the advertiser.

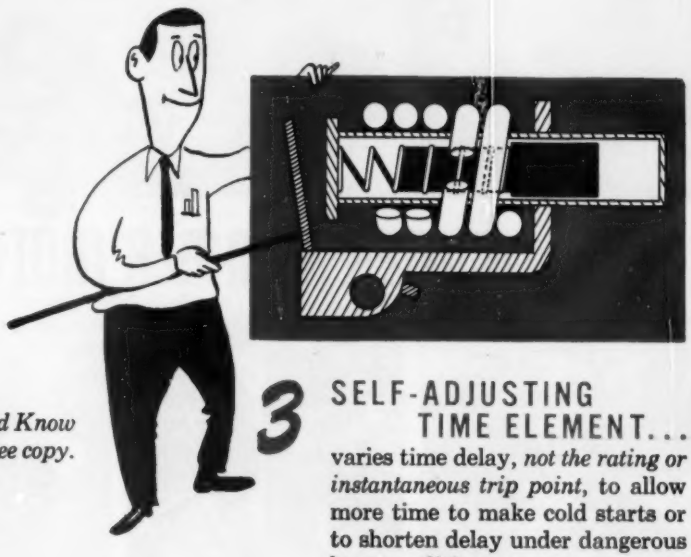
McGraw-Hill Publishing Company, Inc.

ONLY HEINEMANN CIRCUIT BREAKERS give you all THREE

1 **A DEFINITE RATING . . .**
unaffected by temperature. A 20 ampere rating means 20 amperes of safe, usable capacity. There is no de-rating of Heinemann Circuit Breakers.

2 **INVERSE TIME DELAY . . .**
prevents nuisance power interruptions . . . permits starting inrush and harmless, temporary overloads. Gives maximum protection without inconvenience.





3 **SELF-ADJUSTING TIME ELEMENT . . .**
varies time delay, *not the rating or instantaneous trip point*, to allow more time to make cold starts or to shorten delay under dangerous heat conditions.

INFORMATIVE BOOKLET: *"What You Should Know About Circuit Breakers"... Send for your free copy.*

HEINEMANN *Circuit breakers*

HEINEMANN ELECTRIC COMPANY
132 PLUM STREET
TRENTON 2, N. J.

New Cutler-Hammer 9101 Switch joins a distinguished family of Small Motor Control Champions

ELECTRICAL INSTALLERS of the many devices for home, store or factory using motors up to 1 HP praise easy wiring of the new Cutler-Hammer 9101.

MACHINERY BUILDERS have been quick to adopt the new Cutler-Hammer 9101 for standard original equipment . . . better protection plus speedier installation.

AUTHORIZED DISTRIBUTORS everywhere proudly feature the new Cutler-Hammer 9101 Motor Switch . . . offer two-pole and single-pole models from stock.

CUTLER-HAMMER MOTOR CONTROL

CUTLER-HAMMER 9115 MANUAL STARTER—For dependable across-the-line starting and eutectic overload protection of single phase and polyphase motors up to 2 HP.

CUTLER-HAMMER 9586 AUTOMATIC STARTER—C-H 9586 Size 0 Automatic Starter permits economical and safe remote pushbutton control of motors up to 2 HP.

CUTLER-HAMMER 9441 DRUM SWITCH—Choice of the men who want the best in a switch for reversing or special control of machines in the home workshop.

CUTLER-HAMMER 10017 PRESSURE SWITCH—Both manufacturers and installers of pumps and water supply units say this widely used pressure control switch is the finest.

Washington Report

A moderate pick-up in business is predicted for the next few months. No sharp upsurge is expected, and neither is any sharp turn for the worse. Factors which continue to stabilize the economy include a record year in new building construction, a gain of about 8% in electric power production over record 1953, an upturn in steel production from its low rate of about 65% of capacity in mid-summer to nearly 75% of capacity currently, stable prices, improved retail sales in recent weeks, and a slight increase in net personal income after taxes to a new record. With elections now out of the way, business decisions over the next few weeks will reflect the outlook short-range. Forecasts long-range are for a stable but slow growth, due in great part to the stable growth in population.

So-called "Fair Trade" laws to be tested in the Supreme Court's fall session, are frowned on generally by most Washington officials as a depression-born idea which permits one group of the population to parasite on the others. It is considered a prop for the few which must be paid for by the many, which also implies that high prices are fairer than lower prices. Watch for the high court's decision. It may directly affect "Discount House" operations.

The construction boom will shatter all records this year, and continue on well into 1955, say forecasters in Depts. of Commerce and Labor. New building construction in September topped $3.6 billion, same volume as in August, but 8% ahead of the same month last year. Expenditures for first nine months were $27.4 billion, or 4% above the like 1953 period.

Total new building construction is now forecast at $36.5 billion for 1954, and at over $15 billion for maintenance and repair. Total volume is therefore expected to approach $52 billion, highest rate for all time.

Construction which is expected to be maintained or to increase includes residential and commercial building, highways, and heavy engineering activities. Industrial plant and equipment outlays are expected to decline by some 10% during this quarter from previous rates.

The $50 billion, ten-year highway construction program proposed by President Eisenhower this summer has real significance and importance. It is expected to be referred to Congress in January for early action. Note that current highway new construction spending is about $4 billion annually. Eisenhower's new highway program would more than double the current rate, to about $9 billion a year, and greatly bolster the economy. Note also that current highway construction requires more electrical construction work per dollar of outlay than ever before, boosting the market outlook in this field.

Local airports are to receive $20.5 million in Federal funds, and schools another $20 million, to pep up activities in these two fields in the months ahead.

Copper supplies are tight as a result of strikes in the U. S. and Chile several weeks ago. The unusual current demand is due to this temporary shortage rather than upturn in fabrications' needs. New producing capacity of more than 700,000 tons annually are to be added by the end of 1956, which added to present capacity is adequate to meet total world demands for several years ahead.

Steel production has turned up slightly over recent weeks to its current rate of about 75% of capacity, roughly equal to the 1947-49 average—largely a boom period reflecting the accumulated needs of 15 years of depression and war.

Aluminum output is leveling off at a high plateau of 125,000 tons monthly, or some 8-10% above last year's rate.

DUTCH BRAND Insulating Foursome...

the correct selection to meet the many Code requirements

DUTCH BRAND
Friction Tape

A friction tape with known and proven quality... for over forty years. Non-raveling... strong... 4 ply process... correct adhesion... no pin holes... high dielectric splices ... 2000 volts for a single thickness... long life. It costs no more to have this top quality tape . . . ask for DUTCH BRAND the next time you order.

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Rubber Insulating Tape

DUTCH BRAND Rubber Insulating Tape fuses instantly without heat and has the high dielectric quality for good splices. It resists up to 18,000 volts through a single thickness. It contains no corrosive chemicals . . . it has long life and is dependable. DUTCH BRAND Rubber Insulating Tape serves a very definite unreplaceable service under electrical codes to meet many electrical insulating requirements.

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PLASTIC TAPE

DUTCH BRAND Plastic Tape is made especially to meet electrical requirements. It is thin and flexible... with 150% stretch. It adheres to irregular shaped surfaces, is excellent for use where space is limited. It resists weather, oils, acids and corrosive chemicals. Dielectric resistance averages 1000 volts per mil of thickness. Available in .007" thickness or .010" thickness for heavy duty work — for use with power driven tape machines.

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"DB" Wire Connectors are DUTCH BRAND top quality products... made to exacting specifications and design. Long skirt for full insulating protection... made of phenolic material, they are weatherproof... vibration proof and resist pull-out, making perfect solderless connections. The knurled design makes them easy to handle and apply. They are available in four standard sizes, DB-1, DB-3, DB-4, DB-6.

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FRICTION TAPE... PLASTIC TAPE... RUBBER TAPE... WIRE CONNECTORS

NOVEMBER . . . . at a Glance

ELECTRIC HEAT—Our special report on electric space heating which begins on page 67 of this issue brings together a compact body of practical information most essential to the selection, layout and application of electric resistance space heating equipments. The spreading interest and activity in electric space heating is one of the most important market developments of the times. Our readers will find the data presented a valuable reference.

An important feature of the heat loss tables is the use of electrical energy equivalents (watt-hours) for the traditional British thermal unit (Btu). This practice, which we adopted in an article in *Electrical Construction and Maintenance* two years ago, appears to be gaining wide industry acceptance. It effects a useful simplication of the arithmetic of heating design. Since the basic problem of heating design is to balance out the heat losses with heat energy and our heat energy is derived directly from electrical watt-hours at practically 100% efficiency, it is convenient to work with the same energy unit for both input and loss.

Electric home heating is more firmly rooted than most of us realize. Much of the development has prospered in areas like TVA and the Pacific Northwest encouraged by very low power rates. But the very great advantages of electric heat, advancing heat insulation techniques, and the rising costs of conventional fuels are broadening the practical market opportunities in all parts of the country.

According to Lowell R. Mart, director of engineering, Electromode Corp., there has been a rapid and continuing growth since 1946 with the best estimates indicating that there are a little over 300,000 homes heated electrically in the United States today. He predicts that the growth of electric home heating will be at a greatly accelerated pace in the next five years, with over 900,000 homes heated electrically by 1960.

SHOWPLACE—What happens when the electrical contractor can go all out on a residential job? Luxurious Progress House in Miami, Fla., wired by William Hepburn & Co., Contracting Electrical Engineers, gives some of the answers. Progress House was designed as a showplace of modern electrical living.

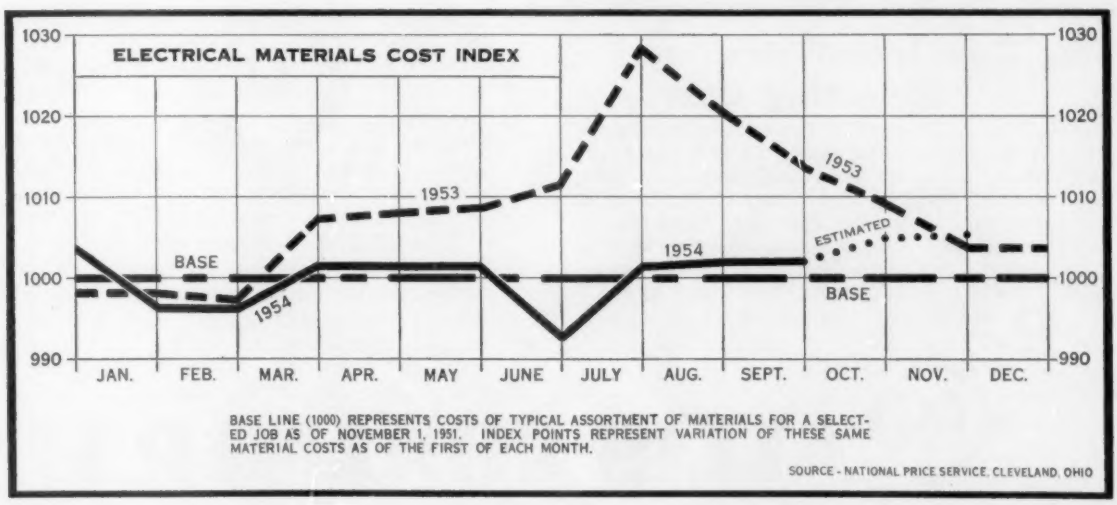
The job includes a 3-phase, 4-wire delta service in 3¼-in. conduit to a 100-amp, 3-phase breaker and a 200-amp single phase breaker. The main panel contains 42 circuits.

The picture story of Progress House beginning on page 92 will suggest many residential wiring ideas equally applicable to smaller homes.

WIRING FOR EXPANSION—Expanding and modernizing a Sacramento, Calif., hospital involved a 7-fold power boost and transfer of existing loads to new equipment without interrupting service. Wismer and Becker were the electrical contractors on this unusual project which presented many unique scheduling problems. The addition was built by the "lift slab" method. The floors are cut at ground level and raised to position with hydraulic jacks. The project also features a steam turbo-generator set for alternate emergency service. The story "Planned Wiring for Hospital Expansion" begins on page 84.

FLOODLIGHTING FOR ARCHIVES—A New floodlighting system now reveals the classic beauty of our National Archives building in Washington, D.C. The job involved the installation of 280 floodlights under two separate contracts, one handled by Roy Lee Company and the other by H. P. Foley Company.

Provisions consisting of conduits and brass boxes were made for floodlighting in the original construction back in 1931. This 23-year old system presented some unusual problems for the electrical contractors. The story, "National Archives Floodlighted", begins on page 80.

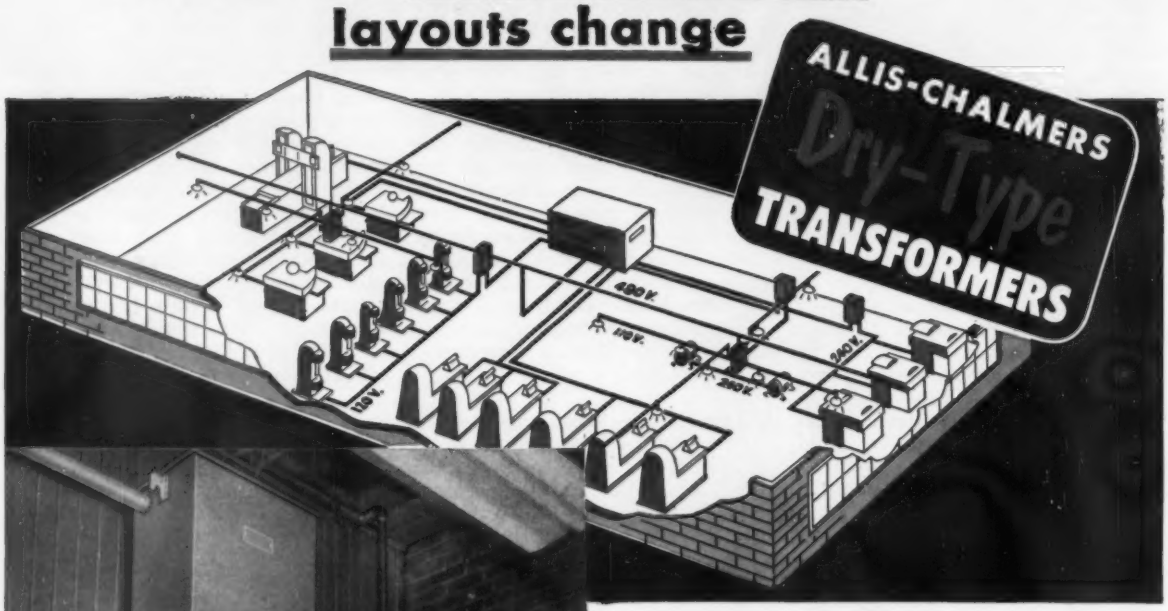


BASE LINE (1000) REPRESENTS COSTS OF TYPICAL ASSORTMENT OF MATERIALS FOR A SELECTED JOB AS OF NOVEMBER 1, 1951. INDEX POINTS REPRESENT VARIATION OF THESE SAME MATERIAL COSTS AS OF THE FIRST OF EACH MONTH.

SOURCE - NATIONAL PRICE SERVICE, CLEVELAND, OHIO

Get Flexibility Like This

for lighting and machine efficiency even when plant layouts change



Low Installation and Operating Cost

Allis-Chalmers dry-type transformers require no expensive vaults. They are safe and clean. They've been designed to fit into modern plant layouts — they are lightweight and easy to handle. There are no gauges to check, no liquids to handle. All you need is routine inspection. Ratings are single-phase, sizes 15 kva and larger; three-phase, sizes 30 kva and larger, 15 kv and larger.

Unusual flexibility in plant power arrangements results when you use Allis-Chalmers dry-type transformers. You get better lighting and improved voltage regulation. For example, when your plant's lights are supplied by their own dry-type transformers, you can change plant layouts without interfering with the normal full power supply you need for good lighting.

In addition, dry-type transformers give you power for machines where you need it — when you need it. They increase machine efficiency by eliminating line drop from long copper runs. They simplify plant layout changes. For a new machine you just add a dry-type transformer where required. You don't need to interrupt power to all stations by tapping into a common bus.

Your local Allis-Chalmers office or distributor will help you plan the most effective power installation for your plant. Or write Allis-Chalmers, Milwaukee 1, Wisconsin for Bulletin 61B6382A. A-4390

A-C ALLIS-CHALMERS

ALLIS-CHALMERS

ELECTRICAL CONSTRUCTION AND MAINTENANCE

54th Year—NOVEMBER • 1954

Safety is Good Business

Safety is everybody's business. But by some quirk of human nature that usually means everybody else. The individual, whether he is the general superintendent or the new apprentice has his own standards and the result is a rate for compensation sometimes greater than net profit on the job.

Management relies on the maturity and common sense of its employees. It is quick to discipline the joker or the irresponsibly careless. Corporate responsibility is covered by insurance and, too often, management lets it go at that, taking on-the-job accidents as the unfortunate but inevitable risks of manual craftsmanship.

What more can be done? Plenty. There is a growing body of experience with planned safety programs in construction. The results are spectacular. They disclose beyond question that job accidents can be reduced, not entirely, but substantially below traditional levels. Even though electrical work is among the less hazardous crafts, the techniques are applicable and can pay off.

Good intentions are not enough, however. Effective safety programs take expert guidance and systematic training of supervisory personnel. They involve job practices that often encounter indifference or actual resistance and the contractor will almost certainly need experienced help to break down these barriers.

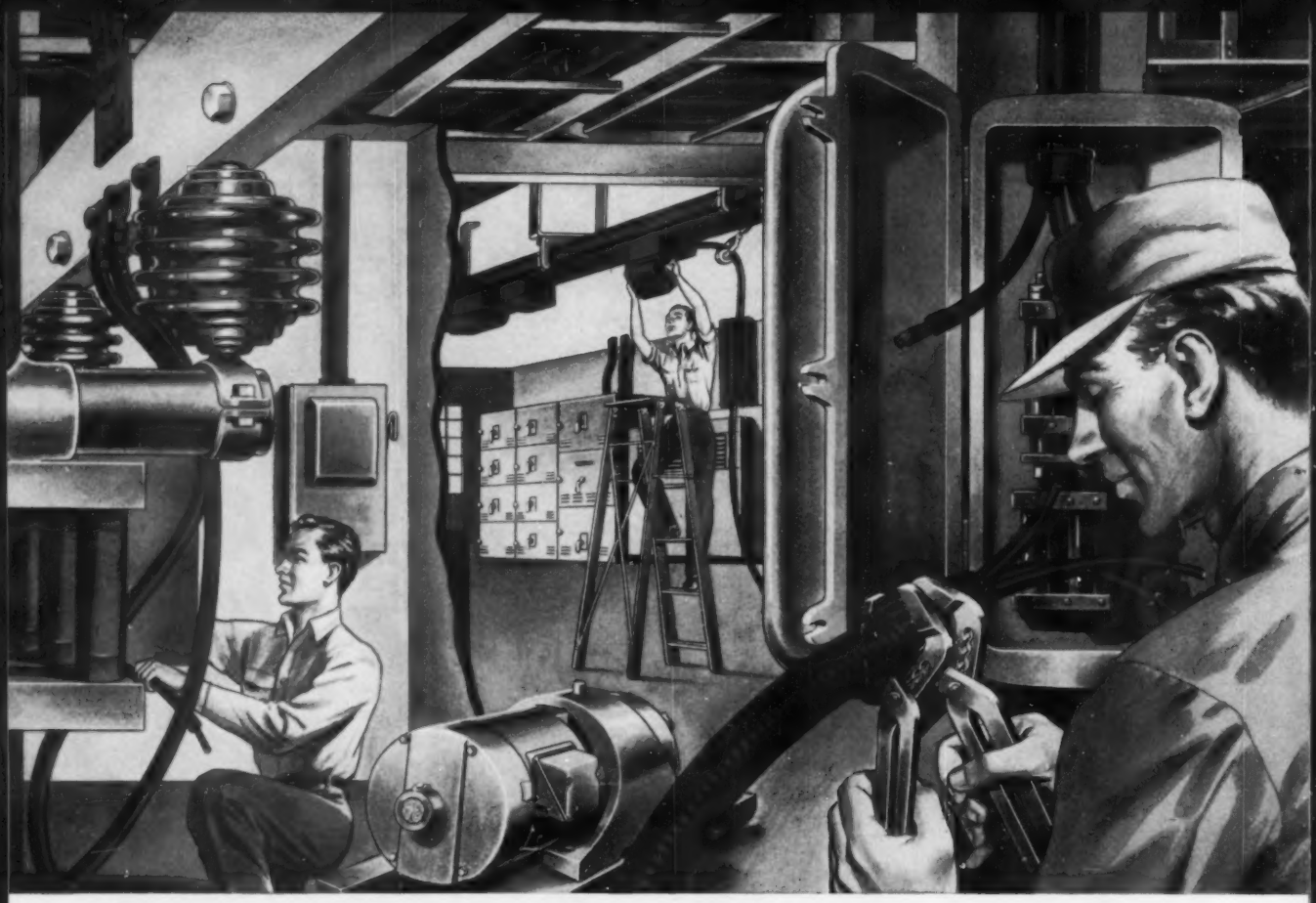
Safety rules requiring hard hats, safety glasses, gloves and safety shoes may appear to make good sense. But the task of converting these rules from imposed nuisances to habitual precautions takes plenty of education and skillful diplomacy.

Most compensation insurers maintain highly trained staffs of safety specialists. These experts have far more knowledge of safety practices than the average contractor can hope to acquire out of his own job experience. They can give invaluable advice and counsel toward setting up and operating an effective program.

The manual rate is costly enough even when it is reduced by better-than-average accident experience. But in these days of scarce skills premiums are only a part of the cost of on-the-job accidents. Among these are lost time, job interruptions, replacement headaches and all the valuable time of supervisory and executive personnel that must be diverted from productive tasks.

Safety is good business. It pays off on the balance sheet. In these days of narrow margins few contractors can afford to ignore the percentage points that can be saved with a well executed safety program.

Wm. F. Stuart



Power distribution systems that can effectively handle future demands are the surest way to avoid electrical obsolescence and costly rewiring.

Local Graybar Representatives will work with you and your customers in the selection of wiring and equipment to meet today's needs . . . and tomorrow's.

"Plan in" future plant flexibility . . . today

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Mineral-insulated cables available via Graybar represent today's newest wiring method. Acting as its own conduit, m.i. cable trains to any contour . . . is unaffected by weather, corrosive vapors, cold or flame.

1. Type m.i. safety mineral-insulated cable — booklet provides complete information on conductor characteristics and suggested applications.

2. NELEX Mineral-insulated heater cable — pertinent data on how it can lower heating costs and provide a higher safety factor is contained in this illustrated booklet.

Planning extra power capacities for future expansion is an important consideration in new plant construction. Today's pressure of electrical growth often outstrips power-carrying capacity long before the equipment itself becomes outmoded. This then, is the most important reason why it pays to call Graybar *first* for planning aid on any wiring job. A Graybar Inside Construction Specialist can not only help you determine a power-distribution system to satisfy your customer's present and near-future needs, but also to "plan in" flexibility for long range expansion.

Over 100,000 different electrical items are distributed by Graybar through its nation-wide system of offices and warehouses. Complete catalog and quotation service covering them is available to help you work out job estimates and specifications — for lighting, power, control, ventilation, communications, as well as wiring. 463-411

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ELECTRICAL CONSTRUCTION AND MAINTENANCE

Vol. 53 No. 11

Facts and figures on . . . .

ELECTRIC SPACE HEATING

Glossary of Heating Terms

Blast heater – Set of heat transfer coils or sections used to heat air which is drawn or forced through it by a fan.

Btu – This is an abbreviation for British thermal unit – a unit of heat quantity. A Btu is the quantity of heat required to raise the temperature of 1 lb. of water 1 Fahrenheit degree.

Comfort zone – The range of effective temperatures over which the majority (50% or more) of adults feel comfortable.

Conduction (thermal) – The process of heat transfer through a material medium by which heat energy is passed from particle to particle within the medium.

Convection – The motion of a fluid due to difference in density and the action of gravity. In heat transmission, this meaning has been extended to include both *forced* and *natural* motion or circulation.

Degree-day – A unit used in estimating fuel consumption and specifying heat load. It is an arbitrary unit based upon temperature difference and time in a particular place. For any day, when the mean temperature is less than 65F, there exists as many degree-days as there are degrees difference between the actual mean temperature and 65F. On a day when the mean temperature was 30F, the degree-days equal 35. When the mean temperature for a day is 65F or greater, the degree-days are zero for that day. Adding up the degree-days for all the days in a year gives "annual degree-days".

Electric heating element – A unit assembly consisting of a resistor, insulated supports, and terminals for connecting the resistor to electric power.

Heater, electric – A complete assembly of heating elements with their enclosure ready for installation.

Panel heating – A heating system in which heat is transmitted by *radiation* and *convection* in varying amounts from panel surfaces to both air and surrounding surfaces.

Radiant heating – A heating system in which only the heat radiated from panels is effective in providing the heating requirements.

Radiation – The transmission of energy by means of electromagnetic waves.

A four-part summary of up-to-date information on this fast growing electrical application, covering—

LOAD CALCULATIONS

EQUIPMENT SPECIFICATIONS

CODE REQUIREMENTS

DIRECTORY OF MANUFACTURERS

ELECTRIC space heating is making its bid. Long stymied by the economy of heat from conventional fuels, electric heat is fast moving toward first place as the heat of the future. Today with proper design and careful application of equipment and controls, electric heat is economical, clean, reliable, safe and efficient. Development of new and better equipment and progress in techniques of thermal insulation for buildings have steadily reduced the operating-cost differential which long favored heat from oil, gas or coal. In more and more cases every day, the advantages of electric heat are winning acceptance over conventional heating—and indicating substantial economy in the long run.

This rapid growth in the use of electric heat has created a pressing need for information. Of course, manufacturers of electric heating equipment make much information available to guide the electrical man in applying electric heat. Other information is available in a range of books and literature, including the "Heating, Ventilating and Air Conditioning Guide." The 1953 National Electrical Code also contains provisions on electrical space heating. But the need of the electrical man has been for a single comprehensive source which covers all of his interests in electric heating.

The following special report is designed to be a job handbook on electric space heating. It covers the subject from design, through equipment selection to finished installation. The facts and figures presented are aimed at the whole electrical team—engineer, contractor, estimator, plant man and inspector.

Heating Calculations

TWO things are of immediate importance in any proposed electric heating installation:

How much heating equipment must be provided? and

What will be the annual cost of electricity?

TOTAL HEATING LOAD

Fundamentally, once a room has been brought to a desired temperature, it will remain at that temperature as long as no heat is allowed to escape from the room. But building materials are not perfect insulators; hence heat does escape. It follows that to maintain the desired temperature within the room, a heating plant must supply as much heat to the room as escapes from the room. The problem, then, is to determine how much heat will escape from the room and what wattage will be necessary to replace this amount of heat.

The quantity of heat which will be lost through a given area of a given material is dependent upon two things:

The difference in temperature between indoors and outdoors, and

The nature of the material.

It would not be practical to provide a heating plant which would be capable of maintaining a given temperature at the absolutely lowest outdoor temperature recorded for the area, since such an extreme would be of very short duration. Therefore an average low temperature for the area, called the *outside design temperature*, has been adopted for representative cities of the United States for use in heating calculations (see Table II). The *indoor design temperature* to be maintained by the heating system is usually taken as 70F for occupancies with persons at rest. Thus, the *design temperature difference* between indoors and outdoors is the difference between the outdoor and indoor design temperatures.

Since the various materials used in building construction vary in the degree to which they conduct heat, the nature and dimensions of the walls, ceilings, floors, etc., of the space to be heated must be ascertained before an estimate of heat loss can be made. A material's *conductivity*, or its ability to transmit heat, is expressed as the number of Btu which will be transmitted through an area of 1 sq ft of the material in 1 hour when the temperature difference between inside and out is 1 degree F, or the number of *Btu per hr per sq ft per degree F temperature difference*. By the application of a simple conversion factor (see Notes under Table I), these *heat transmission coefficients*, as they are called, may be expressed in *watts per sq ft per degree temperature difference*, making them more applicable to electric heating calculations. A portion of the more commonly used materials are listed in Table I.

The last line at the bottom of Table I gives the factors for *Infiltration and Ventilation Air Heat Loss*. These are applied to take care of cold air that leaks into a building through cracks around windows and doors, forcing out an equal amount of warm air.

ANNUAL COST

With a given capacity of heating equipment installed, the annual cost of electricity depends directly upon the amount of time that equipment is in use during the year. To aid in estimating this time, the *degree-day* unit has been developed. From an average of past temperature records, a definite number of annual degree-days has been associated with representative cities throughout the United States (see Table II). The heating period to be expected during the year in any particular location will be proportional to the degree-days for that location; thus they may be used to obtain an estimate of the annual kilowatt-hour consumption.

The logical procedure would be to find the heat loss per degree-day and then multiply this figure by the number of degree-days in a year, resulting in the following expression for annual kilowatt-hours:

$$\frac{\text{watts heat loss} \times \text{degree-days}}{\text{design temperature difference} \times 41.7}$$

However, controlled governmental tests show that annual consumption runs below the results indicated by this formula by amounts varying from 17% to 29%, which is equivalent to increasing the constant 41.7 in the formula to 50 or 59. Such a reduction in the theoretical requirements may be ascribed to such things as shades, curtains and draperies used on windows, radiant heating effect of the sun during the day, etc.—factors not considered in heat loss calculations.

Although several manufacturers recommend cost computations which are equivalent to the use of the higher (59) factor in the above formula, the Federal Housing Administration still recommends the more conservative estimate, equivalent to the use of the factor 50 (see formula under "How to Calculate Heating Load").

With the annual kilowatt-hours determined, an estimate of the yearly cost for electricity may be made by multiplying the kilowatt-hours by the local power rate.

EQUIPMENT RATINGS

When several rooms are involved, each room must be calculated separately, since equipment ratings will vary with the size and character of the room. Knowing the watts required for each room, heating units whose ratings are closest to the calculated values are chosen. Care must be taken to observe the rated voltage of the heaters chosen as well as their wattage, since the effective wattage will vary as the square of the voltage. Electric heating equipment is nominally rated at 120/240 volts; however the actual terminal voltage used in designing the heaters to obtain rated wattage is 118/236.

For example: Assume a given installation is calculated to require a heating load of 22,000 watts. The equipment chosen is rated at 120/240 volts (actually 118/236); but the existing supply is found to be only 115 volts. Due to this reduction in voltage, the effective wattage produced by the heating equipment would be

$$22{,}000 \times (115/118)^2 = 20{,}900 \text{ watts}$$

Therefore, additional heating equipment is needed to make up for this reduction. The actual wattage required may be found as follows:

$$\text{Watts} = \text{calculated watts} \times \left(\frac{\text{rated voltage}}{\text{actual voltage}}\right)^2$$

In this example, the wattage required would be $22{,}000 \times (118/115)^2$ or 23,100 watts.

This formula also applies where the supply voltage exceeds the rated voltage, in which case it would indicate that a reduction in the calculated wattage was in order.

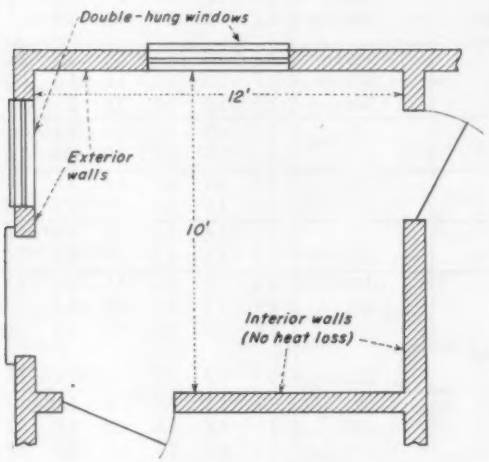
HOW TO CALCULATE HEATING LOAD

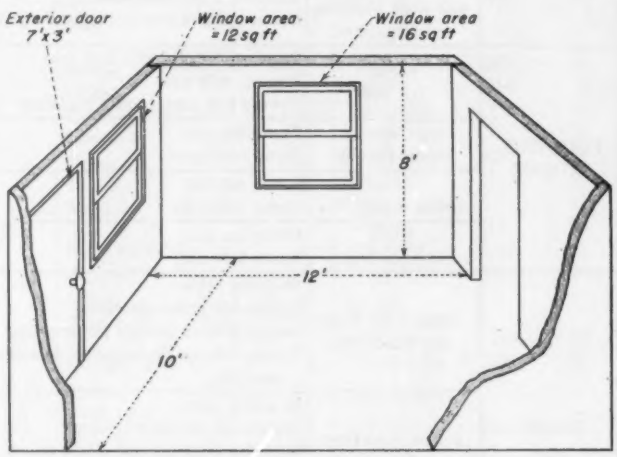
1. Determine the design temperature difference for the area. Use 70F for indoor temperature; obtain outdoor temperature from Table II. Outdoor temp.–indoor temp. = temp. difference.
2. From plans, specifications or actual measurements, determine nature and area of windows, doors, walls, ceilings and floors.
3. From Table I, under the required design temperature difference, obtain transmission factors for the windows, doors, walls, ceilings and floors.
4. Multiply areas found in (2) by appropriate factors found in (3) to obtain watts required to offset heat lost through building materials.
5. Determine volume of space to be heated and number of air changes required per hour (use 1 change per hour if not otherwise specified).
6. From Table I, under the required design temperature difference, obtain transmission factor for infiltration and ventilation air heat loss.
7. Multiply volume (cu ft) obtained in (5) by number of air changes per hour by transmission factor obtained in (6) to get watts required to offset infiltration loss.
8. Add watts obtained in (4) and (7) above. This will be the required rating of the heating equipment.
9. To estimate annual kilowatt-hour consumption, obtain degree-days from Table II and substitute, together with the result of (8) above in the following formula:

$$\text{Annual kwhrs} = \frac{\text{watts heat loss} \times \text{degree-days}}{\text{design temperature difference} \times 50}$$

10. To obtain an estimate of the annual heating cost, multiply the result of (9) by the local power rate.

EXAMPLE





Windows: Single glass with storm sash
Exterior door: 1¾-in solid wood with storm door
Exterior walls: Wood siding with wood sheathing and building paper; insulation board lath, plaster and bat insulation
Ceiling: Single wood floor over wood joists; gypsum lath and plaster ceiling; unheated attic above
Floor: Concrete slab, poured on ground
Assume 1 change of air per hour due to normal infiltration of outside air.

From Table II:

Outside design temperature for New York City: 0°F
Design temperature difference: 70−0=70F
Degree-Days for New York City: 5280

Calculations:

Material	Transmission Factor (Table I, Column F)	Area (sq ft)	Watts
Windows	12.6	16+12=28	28×12.6= 353
Door	6.2	7× 3=21	21× 6.2= 130
Walls	1.8	(12×8)+(10×8)−28−21=127	127× 1.8= 229
Ceiling	1.6	10×12=120	120× 1.6= 192
Floor	2.1	10×12=120	120× 2.1= 252
Infiltration	0.371	Volume=12×10×8=960 cu ft	960×1×.371= 356
		Total Watts Required...	**1512**

$$\text{Annual kilowatt-hours} = \frac{1512 \times 5280}{70 \times 50} = \mathbf{2280}$$

Annual cost (at $.025 per kw=hr) = 2280× .025 = **$57.00**

TABLE I: RATE OF HEAT TRANSMISSION

Construction Details			Transmission Factor (watts/sq ft)						
			Per Degree Fahrenheit Temp Diff (A)	Design Temperature Difference (°F)					
				30 (B)	40 (C)	50 (D)	60 (E)	70 (F)	80 (G)
WALLS, MASONRY	12-inch Brick	Plaster	.100	3.0	4.0	5.0	6.0	7.0	8.0
		Gypsum lath, plaster, furred	.070	2.1	2.8	3.5	4.2	5.1	5.8
		Gypsum lath, plaster, furred blanket insulation	.038	1.1	1.5	1.9	2.3	2.7	3.0
	12-inch Hollow Concrete Block, Cinder Aggregate	Plaster	.105	3.2	4.2	5.3	6.3	7.4	8.4
		Gypsum lath, plaster, furred	.073	2.2	2.9	3.7	4.4	5.1	5.8
		Gypsum lath, plaster, furred blanket insulation	.038	1.1	1.5	1.9	2.3	2.7	3.0
	12-inch Poured Concrete	Plaster	.155	4.7	6.2	7.8	9.3	10.9	12.4
		Gypsum lath, plaster, furred	.097	2.9	3.9	4.9	5.8	6.8	7.8
		Gypsum lath, plaster, furred blanket insulation	.044	1.3	1.8	2.2	2.6	3.1	3.5
WALLS, FRAME	Wood Siding with Wood Sheathing and Bldg. Paper	Insulating board lath, plaster	.056	1.7	2.2	2.8	3.4	3.9	4.5
		Insulating board lath, plaster, bat insulation	.025	0.8	1.0	1.3	1.5	1.8	2.0
	Brick Veneer Siding with Wood Sheathing and Bldg. Paper	Insulating board lath, plaster	.059	1.8	2.4	3.0	3.5	4.1	4.7
		Insulating board lath, plaster, bat insulation	.025	0.8	1.0	1.3	1.5	1.8	2.0
	Stucco with Wood Sheathing and Bldg. Paper	Insulating board lath, plaster	.065	2.0	2.6	3.3	3.9	4.6	5.2
		Insulating board lath, plaster, bat insulation	.026	1.8	1.0	1.3	1.6	1.8	2.1
PARTITIONS, INTERIOR	Frame, 2x4 Studs	Gypsum lath and plaster, both sides	.100	3.0	4.0	5.0	6.0	7.0	8.0
		Plywood, both sides	.097	2.9	3.9	4.9	5.8	6.8	7.8
		Plywood both sides, blanket insulation	.044	1.3	1.8	2.2	2.6	3.1	3.5
	4-inch Hollow Clay Tile	Plaster one side	.123	3.7	4.9	6.2	7.4	8.6	9.8
		Plaster both sides	.117	3.5	4.7	5.9	7.0	8.2	9.4
	4-inch Hollow Gypsum Tile	Plaster one side	.082	2.5	3.3	4.1	4.9	5.7	6.6
		Plaster both sides	.079	2.4	3.2	4.0	4.7	5.5	6.3
	4-inch Common Brick	Plaster one side	.135	4.0	5.4	6.8	8.1	9.5	10.8
		Plaster both sides	.126	3.8	5.0	6.3	7.6	8.8	10.0
FLOORS and CEILINGS	Single Wood Floor over Wood Joists	No ceiling below	.132	4.0	5.3	6.6	7.9	9.2	10.6
		Gypsum lath and plaster ceiling	.082	2.5	3.3	4.1	4.9	5.7	6.6
		Insulating board lath and plaster ceiling	.062	1.9	2.5	3.1	3.7	4.3	5.0
		Gypsum lath and plaster ceiling, mineral wool insulation	.023	0.7	0.9	1.2	1.4	1.6	1.8
	Double Wood Floor over Wood Joists	No ceiling below	.096	2.9	3.8	4.8	5.8	6.7	7.7
		Gypsum lath and plaster ceiling	.070	2.1	2.8	3.5	4.2	4.9	5.6
		Insulating board lath and plaster ceiling	.053	1.6	2.1	2.7	3.2	3.7	4.2
		Gypsum lath and plaster ceiling, mineral wool insulation	.022	0.7	0.9	1.1	1.3	1.5	1.8
	3-inch Concrete Floor	Asphalt tile floor covering; no ceiling below	.193	5.8	7.7	9.7	11.6	13.5	15.4
		Asphalt tile floor covering; suspended gypsum board and plaster ceiling	.103	3.1	4.1	5.2	6.2	7.2	8.2
		Double wood floor on sleepers over concrete	.073	2.2	2.9	3.7	4.4	5.1	5.8
		Basement floor poured on ground	.030	0.9	1.2	1.5	1.8	2.1	2.4
DOORS	Thin Wood Panel	Exposed	.250	7.5	10.0	12.5	15.0	17.5	20.0
		With storm door	.114	3.4	4.6	5.7	6.8	8.0	9.1
	1½-inch Solid Wood	Exposed	.150	4.5	6.0	7.5	9.0	10.5	12.0
		With storm door	.088	2.6	3.5	4.4	5.3	6.2	7.0
GLASS AREA	Single glass		.330	9.9	13.0	16.5	19.8	23.1	26.4
	Double glass, ¼-inch air space (or single glass with storm sash)		.180	5.4	7.2	9.0	10.8	12.6	14.4
	Hollow glass block, 5¾ x 5¾ x 3⅞ inches		.180	5.4	7.2	9.0	10.8	12.6	14.4
INFILTRATION AND VENTILATION AIR HEAT LOSS per cu ft per hour			.0053	.159	.212	.265	.318	.371	.424

NOTES:

- Factors given above are based on the following thicknesses of materials:
  Plaster: ½ inch
  Gypsum lath: ⅜ inch
  Furring: 2-inch strips, 1 air space
  Blanket insulation: 1 inch
  Wood sheathing: 25/32 inch
  Insulating board lath: ½ inch
  Bat insulation: 2 inches
  Plywood: ¾ inch
  Mineral wool insulation: 3 inches
- Values given in Column A are obtained by dividing the Heat Transmission Coefficient in btu per hr per sq ft per degree F temperature difference by 3.413 btu per hour per watt
- Factors given for construction using gypsum lath may be used with negligible error for constructions using metal lath, wood lath or decorated gypsum board.
- Design Temperature Difference = outside design temp. — inside design temp. For design temperature differences not given in table, transmission factors may be found by multiplying the watts/sq ft per °F temp. diff. given in column A above by the design temperature difference.

TABLE II: DEGREE-DAYS AND DESIGN TEMPERATURES (°F)

Locality	Annual Degree Days	Outside Design Temp.
ALABAMA		
Anniston	2806	+ 10
Birmingham.	2611	+ 10
Mobile	1566	+ 20
Montgomery	2071	+ 15
ARIZONA		
Flagstaff	7241	− 10
Phoenix	1441	+ 20
Yuma	1036	+ 30
ARKANSAS		
Fort Smith	3226	+ 5
Little Rock	3009	+ 5
CALIFORNIA		
Eureka	4758	+ 25
Fresno	2403	+ 10
Los Angeles	1391	+ 35
Red Bluff	2653	+ 25
Sacramento	2680	+ 25
San Diego	1596	+ 35
San Francisco	3137	+ 35
San Jose	2823	+ 30
COLORADO		
Denver	5839	− 10
Grand Junction	5613	− 20
Pueblo	5558	− 10
CONNECTICUT		
Hartford	6113	0
New Haven	5880	0
D. C.		
Washington	4561	0
FLORIDA		
Apalachicola	1252	+ 25
Jacksonville	1185	+ 20
Key West	59	+ 40
Miami	185	+ 40
Pensacola	1281	+ 20
Tampa	571	+ 25
GEORGIA		
Atlanta	2985	+ 10
Augusta	2306	+ 15
Macon	2338	+ 15
Savannah	1635	+ 20
IDAHO		
Boise	5678	− 10
Pocatello	6741	− 15
ILLINOIS		
Cairo	3957	0
Chicago	6282	− 10
Peoria	6004	− 10
Springfield	5446	− 10
INDIANA		
Fort Wayne	6232	− 12
Indianapolis	5458	− 10
Terre Haute	5117	− 10
IOWA		
Charles City	7624	− 15
Davenport	6252	− 10
Des Moines	6378	− 10
Sioux City	6905	− 20
KANSAS		
Concordia	5425	− 10
Dodge City	5069	− 10
Topeka	5075	− 10
Wichita	4644	− 10
KENTUCKY		
Louisville	4417	0
LOUISIANA		
New Orleans	1203	+ 20
Shreveport	2132	+ 15
MAINE		
Eastport	8445	− 10
Greenville	9439	− 20
Portland	7377	− 10
MARYLAND		
Baltimore	4487	0
MASSACHUSETTS		
Boston	5936	− 5
MICHIGAN		
Detroit	6560	0
Grand Rapids	6702	− 10
Lansing	7149	− 10
MINNESOTA		
Duluth	9723	− 25
Minneapolis	7966	− 20
St. Paul	7975	− 20
MISSISSIPPI		
Meridian	2330	+ 10
Vicksburg	2069	+ 10
MISSOURI		
Columbia	5070	− 10
Kansas City	4962	− 10
St. Louis	4596	− 5
Springfield	4569	0
MONTANA		
Havre	8416	− 35
Helena	7930	− 25
Miles City	7591	− 35
NEBRASKA		
Lincoln	5980	− 10
North Platte	6384	− 15
Valentine	7197	− 20
NEVADA		
Reno	5621	0
Winnemucca	6357	− 15
NEW HAMPSHIRE		
Concord	7400	− 10
NEW JERSEY		
Atlantic City	5015	0
Cape May	4870	0
Newark	5500	0
Sandy Hook	5369	0
Trenton	5256	0
NEW MEXICO		
Albuquerque	4517	− 5
NEW YORK		
Albany	6648	− 10
Binghamton	6818	− 10
Buffalo	6925	− 10
Canton	8305	− 20
Ithaca	6914	− 10
New York	5280	0
Oswego	7186	− 10
Rochester	6772	− 10
Syracuse	6899	− 10
NO. CAROLINA		
Charlotte	3224	+ 10
Raleigh	3275	+ 10
Wilmington	2420	+ 15
NO. DAKOTA		
Bismarck	8937	− 30
Devils Lake	10104	− 30
Williston	9301	− 35
OHIO		
Cincinnati	4990	0
Cleveland	6144	0
Columbus	5506	0
Dayton	5412	0
Sandusky	6095	0
Toledo	6269	0
OKLAHOMA		
Oklahoma City	3670	0
OREGON		
Baker	7197	− 10
Medford	4650	+ 10
Portland	4353	+ 10
Roseburg	4332	+ 10
PENNSYLVANIA		
Erie	6363	− 5
Harrisburg	5412	0
Philadelphia	4739	0
Pittsburgh	5430	0
Reading	5232	0
Scranton	6218	− 5
RHODE ISLAND		
Block Island	5897	0
Providence	5984	0
SO. CAROLINA		
Charleston	1866	+ 15
Columbia	2488	+ 10
Greenville	3059	+ 10
SO. DAKOTA		
Huron	7940	− 25
Rapid City	7197	− 25
TENNESSEE		
Chattanooga	3238	0
Knoxville	3665	0
Memphis	3090	+ 5
Nashville	3613	0
TEXAS		
Abilene	2573	+ 10
Amarillo	4196	− 5
Brownsville	628	+ 30
Corpus Christi	965	+ 25
Dallas	2367	+ 10
Fort Worth	2355	+ 10
Houston	1315	+ 15
Palestine	2068	+ 15
Port Arthur	1352	+ 15
San Antonio	1435	+ 20
UTAH		
Modena	6598	− 10
Salt Lake City	5650	− 15
VERMONT		
Burlington	8111	− 15
VIRGINIA		
Cape Henry	3558	+ 10
Lynchburg	4068	0
Norfolk	3364	+ 10
Richmond	3922	+ 5
WASHINGTON		
North Head	5367	+ 15
Spokane	6318	− 15
Tacoma	5039	+ 10
Tatoosh Island	5857	+ 15
W. VIRGINIA		
Elkins	5800	0
Parkersburg	4928	0
WISCONSIN		
Green Bay	7931	− 20
LaCrosse	7421	− 20
Madison	7405	− 20
Milwaukee	7079	− 15
WYOMING		
Cheyenne	7536	− 15
Lander	8243	− 20

Heating Equipment

THE various equipment in use today for the heating of space intended for human occupancy is identified by a variety of nomenclature by the many heater manufacturers. To eliminate misunderstanding throughout this article, electric heating equipment has been arbitrarily divided into four general classifications according to the method by which the heat is distributed. These four types are natural convection heaters, forced convection heaters, radiant heaters and duct heaters.

NATURAL CONVECTION HEATERS

A wide range of electric heating equipment operates on the principle of convection—creating circulating currents of warm air without the use of a fan or blower. With this type of equipment, the sequence of heat distribution is as follows:

1. The heating element heats the air which surrounds it;
2. This heated air begins to rise and cooler air comes up from below;
3. This cooler air is in turn heated as it comes in contact with the heating element, then follows the rise of the first mass of heated air.

This action is continuous—heated air moving up away from the heater, and cooler air moving up to the heater from below—causing circulating currents of warm air.

In addition to producing these currents, almost all convection heating units produce some radiant heat, varying in amount with the designs of various units.

Natural convection heating units are made in a number of basic designs suited to particular applications and allowing a variety of mounting positions within the space to be heated. The basic unit types are as follows:

Wall Panels—This is the most common type of convection heating unit. Available in a wide range of sizes, designs and appearances, wall panel electric heaters are made for both surface and recessed mounting. They can be used singly to supplement existing heating systems, or they can be used as an overall system in themselves. Each unit is usually equipped with a thermostat and a small circuit disconnecting switch.

Construction of wall panel convectors follows a pattern. Heating elements consist of coiled nickel chromium resistance wire either stretched between terminals or wrapped around hollow, cylindrical ceramic forms within the unit. The heating elements are exposed on the side of the heater which faces into the space to be heated. The use of hollow cylinder forms, either fixed diameter or tapered cone types, improves circulation of air through the unit. Behind the heating elements, a copper or steel reflector is placed to keep the heat from going back into the wall and to reflect the radiant heat out into the space. The main housing consists of a steel pan deep enough to allow circulation of air between the back of the reflector and the extreme back of the unit. Each unit is equipped with a decorative frame and a front grille to prevent contact with the hot elements.

Most of the units described above are designed to provide both heat by convection and heat by radiation. Depending upon the ratio of horizontal to vertical dimension, arrangement of heating elements and reflectors and the type of grille used, heat by convection makes up between 40% and 80% of the total heat output.

Wall panel unit heaters are made in varying widths and heights. Typical sizes are: 21-in. by 8-in., 14 in. by 18-in., 18-in. by 10-in., 54-in. by 20-in., 8-in. by 46-in. These units can be used in residential, commercial and industrial installations. The radiant heat output heats persons and objects in the path of the radiation; the convection heat circulates throughout the space from floor to ceiling and into every corner. Optimum speed of circulation is about 200 feet per minute. Furniture or other objects should not be placed in front of units which have radiant heat output. Solid objects block radiant heat. Units which provide almost 100% convection heat require only a minimum of space in front of them to allow air circulation. Because radiant heat is almost instantaneous, units with a high degree of radiant output are particularly well suited to bathrooms, kitchens or other small rooms where local heating problems exist. Of course, any residential interior or other interiors for human occupancy—schools, auditoriums, offices, stores, theatres—can be heated by natural convection heaters, either as primary heat sources or supplementary sources.

In addition to the above units, there are several models of convection heaters which distribute heat solely by convection. Some of these are essentially the same as the above units, with a metal plate on the grille to baffle radiant heat developed. Other units for surface mounting contain straight tubular elements encasing resistance wire. Radiating fins are closely spaced along the tubular element. These latter units are commonly used in pump houses, valve houses, crane cabs and elevators. Some models are made for residential and commercial use.

Installation details for the many models of natural convection units are provided by the manufacturers. Type and dimensions of framing members—studs, headers, plates—are usually given. General installation requirements are as follows: heaters should be mounted on exterior walls, beneath or alongside windows, for best circulation of warm air; heaters should be installed according to the NEC; adequate control should be provided for each unit; bottom edge of recessed heater panel should be about 7 inches above the finished floor; connection of circuit should be made according to instructions.

Baseboards:—Natural convection baseboard heaters are used primarily in residences, although they can also be used in offices, apartments and similar small spaces. They are designed to simulate conventional wood baseboards. Like the wall panels, these heaters may also have some radiant heat output in addition to providing heat by convection. The radiant heat tends to heat the floor which in turn heats air in contact with its surface—a secondary convection effect. Baseboard heaters which do have radiant output should be exposed as much as possible. Of course, the major effect, convection, will be accomplished no matter how the furniture is placed.

One type of baseboard heater contains horizontal runs of coiled resistance wire along the length of a 6-in. high, shallow steel enclosure, with internal construction to allow vertical passage of air through the baseboard. The elements heat the air passing through and also heat the side of the baseboard which faces the space to be heated. The surface of this heated metal side is then the source of radiant heat. The unit is available in standard lengths for assembly into desired lengths. This type of baseboard heater is available with control (thermostat and switch) sections which

can be placed in the run of the baseboard. End sections and corner sections are also available. Along the bottom of the baseboard is a wireway; leads are brought into the heater through knockouts in the control section.

Another type of baseboard heater contains a finned tubular heating element along the length of the unit's 10-in.-high enclosure. This type provides straight convection heat.

Floor Furnaces—This type of natural convection heater consists of a heavy gauge galvanized steel box, between 13 and 18 inches deep, with an open top about 14 inches wide and 24 inches long, containing resistance heating elements. The box has a sturdy grille top and is mounted between floor joists with the grille flush with the finished floor. Within the box, the heating elements are mounted within another four-sided enclosure with open top and open bottom. This enclosure consists of double-wall casing around the elements to prevent loss of radiant heat from the elements and to provide incoming channels for passage of air between the sides of the box and the walls of the element-enclosure. Air then comes down into the box through these passages and is carried by convection up through the inside enclosure across the heating elements, then up to the space to be heated. The heating elements are either lengths of coiled resistance wire stretched in horizontal layers across the area of the enclosure or vertical, hollow ceramic cylinders with coiled resistance wire wrapped around them. Floor furnaces have built-in thermostats for economical usage and completely automatic operation. The grille and heating elements can be removed for cleaning of the box.

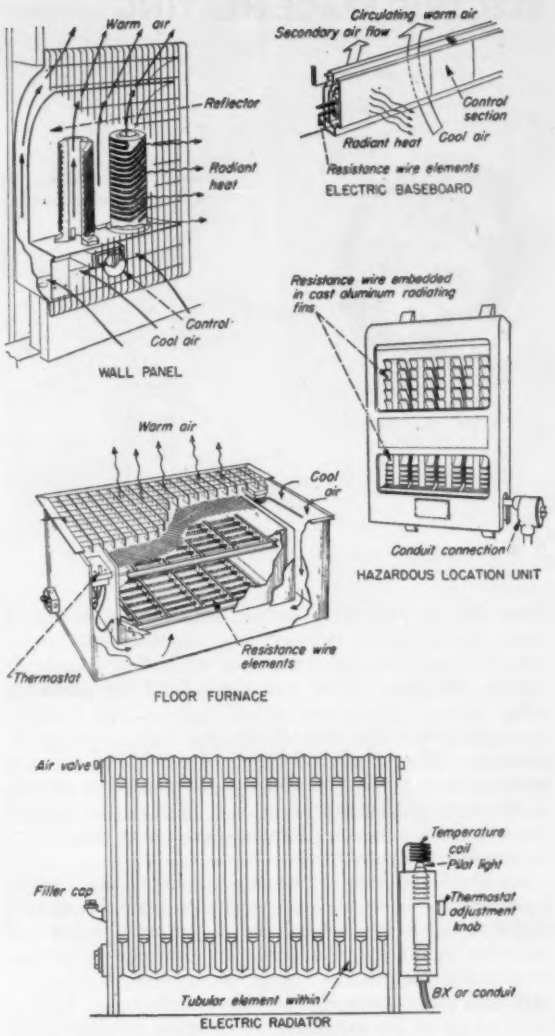
Floor furnaces can be applied singly or as complete systems in homes, stores, departments and similar interiors.

Electric Radiators—This type of natural convection heater consists of a smooth, cast-iron radiator (similar to the kind used with conventional fuel heating systems), containing a tubular resistance immersion heating element which is mounted in the bottom to heat water in the unit and produce steam. Operation of the unit is the same as that with any steam radiator; both radiant and convection heat is produced.

Electric steam radiators are available in fixed and portable units for use either singly or in a complete system. Controls are built into the unit. Typical applications are: residences, offices, stores, small industrial areas.

Hazardous Location Units—A range of natural convection heaters are made for installation in hazardous locations—Class I, Groups C and D; Class II, Groups E, F and G. These include: bracket type, resistance element, grilled front convectors; bracket-mounted convection units with resistance wire cast in aluminum radiating fins; and electric steam radiators. These heaters are equipped with controls and conduit boxes for circuit connection.

Portable Heaters—Portable type, natural convection heaters are available for limited space heating applications. These units have power cords and plugs for connection to receptacles; handles are provided on some models. Units include: convection-radiant, exposed-resistance-element heaters; and electric steam radiators.



NATURAL CONVECTION HEATERS

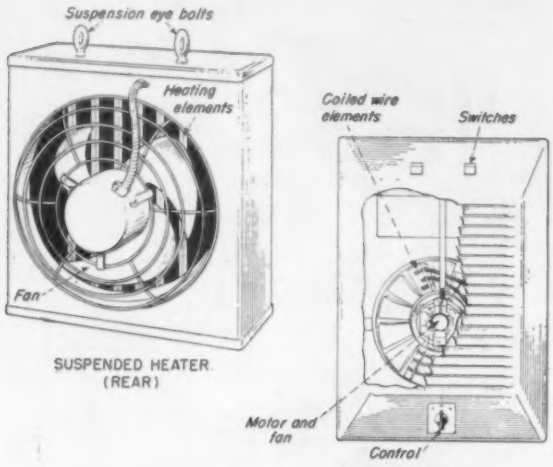
FORCED CONVECTION HEATERS

Basically, a forced convection heater is a natural convection heater equipped with a fan or blower to increase the circulation of warm air. Of course, the housing of the unit is larger and constructed to accommodate the fan and motor. Types of heating elements, arrangements of elements and fans and general construction vary with the different units, depending upon size and application for which the unit was designed.

Forced convection heaters can be roughly divided into two general types: wall panel heaters, and suspended- or bracket-type heaters.

Wall Panels—Operation, application and installation of this type of forced convection heater are about the same as in the case of wall panel natural convection heaters, with the addition of the fan. Radiant heat is only a small part of the output of this type of unit. A few models, however, do utilize radiant heat in addition to the forced convection heat. In general, forced convection panel units provide higher heat output and greater circulation and better distribution of warm air than natural convection units. They may be used singly for supplemental or off-season heat, or they can be used as primary heat sources in residential, commercial and some industrial areas.

Several types of heating elements are found in forced convection heaters. One type consists of resistance wire



FORCED CONVECTION HEATERS

embedded in aluminum casting which is made up of closely spaced square radiating fins. Another unit uses a cast aluminum heating element of radial fins, completely covering the front of the unit just behind the protective grille. In many units, bare coiled resistance wire is either zig-zagged across the face of the unit behind the grille, mounted on insulators in the form of concentric circles or mounted horizontally. In all units, the mounting position of the heating elements is such as to maximize natural convection currents and place the elements in the path of the fan-driven air currents.

Installation of these heaters requires cutting and framing a suitable hole in the wall, mounting the wall box, making electrical circuit connections and mounting the unit and face plate in the box. Knockouts are provided in the box for electrical connection. Specific details on installations of particular units is provided by the manufacturer. Instructions are given for installation in existing buildings or in new constructon. Some surface mounting heaters of this type are also available. Thermostatic control and safety switch are usually built into these heaters.

Suspended Heaters—These forced convection heaters are designed to be suspended from the ceiling or walls. They are equipped with hangers or mounting brackets, contain encased heating elements and a fan or blower to provide increased circulation of warm air. Generally, these units are much larger than the above described wall panel heaters and are used in large commercial and industrial areas.

Small units of the suspension type contain cast aluminum finned heating elements or finned steel elements. Fans vary in size to provide the right amount of circulation for the amount of heat developed. Large units have horizontal, steel jacketed strip heating elements or steel finned elements. All units may be used for auxiliary heat or as main heating sources. Mounting brackets on some units allow discharge of air at almost any angle. Electric supply conductors are brought down to a unit from the ceiling or walls.

Appearances of exterior housings of units vary depending up on the applications for which the units were designed. In offices, stores and other commercial interiors, attractive casings are used. Completely functional units are used as industrial interiors.

Forced convection heaters are also available as portable units, for mounting on pedestals, and as large self-contained units for floor mounting.

RADIANT HEATERS

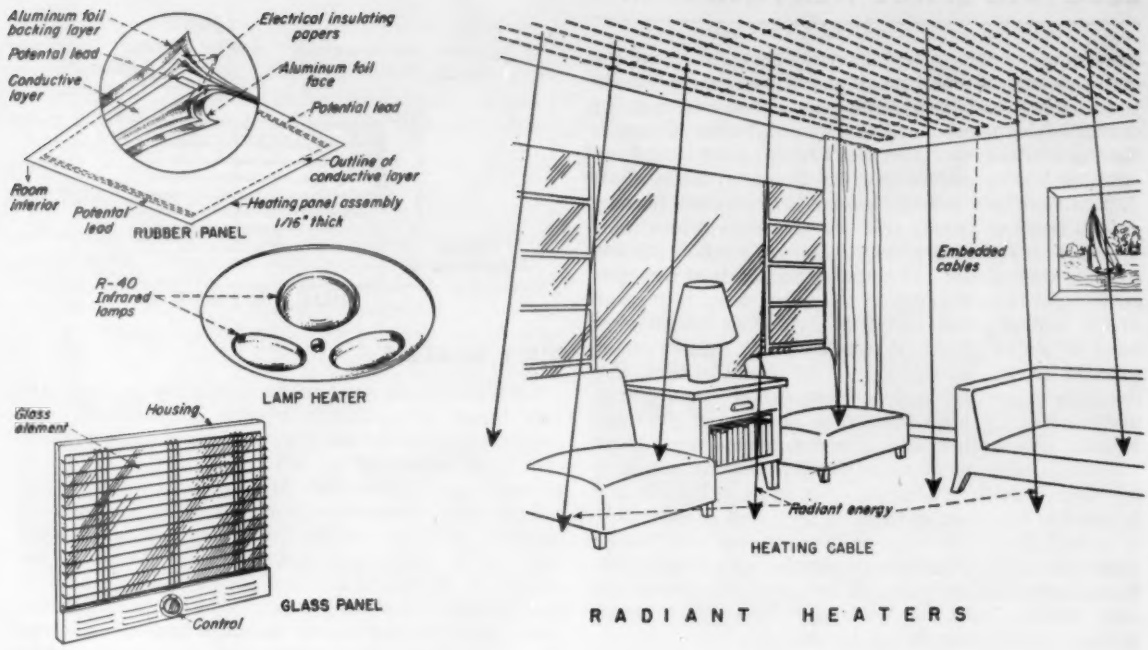
This type of heating equipment produces electromagnetic waves of heat energy. This type of heating is called radiant heating. In theory, persons or objects which are in the path of radiant heat energy are heated, but air in the intervening space through which the radiant waves passed is not heated. The classic example of radiant heat is heat from the sun. Everyone notices this effect on bright sunny days in the cold of winter. The air is cold and the temperature may be below freezing, but a distinct warmth can be felt on the face when the sun's rays fall on it. Electric radiant heating panels produce the same type of heat. A small measure of heat by convection is produced secondarily from the surface of the heat source and the surfaces of objects heated, but this effect is small.

A variety of equipment types is available for producing radiant heat. These different equipments vary in construction and operation, but the output is the same. The following covers each of the basic types, including application and installation.

Glass Panels—Shallow glass panel sources of radiant heat are available in a wide range of sizes. Typical dimensions for these panel units, which are about 2 inches deep, are as follows: 14-in. by 22-in., 38-in. by 12-in., 26-in. by 22-in., 20-in. by 20-in. Designed for surface or recessed mounting on walls, for baseboard installation and for surface and suspended ceiling mounting, glass heating panels find application in homes, offices, stores—as either primary or secondary heat sources.

Basically, a glass heating panel consists of a shallow pan housing, an aluminum or stainless steel reflector, a glass panel with enclosed heating element and finishing trim. Of course, construction features vary with different models. In one unit, the resistance element consists of a ceramic metallic oxide grid fused into the back surface of the glass panel. Electric current passing through this filament grid raises the temperature of the glass to about 340 F. Radiant heat is developed and directed into the space to be heated by an aluminum reflector behind the glass. Passage for air circulation is provided between the glass panel and the reflector. The heating grid in the glass is connected to the supply circuit by two conductors which emerge from the glass at its bottom edge. Another glass heating panel uses an aluminum grid fused in the glass panel. In still another unit, the entire back surface of the glass panel has an electrically conductive coating which makes the whole surface one solid heating element. Two brass bus bars make contact with the two silver terminating edges of the coating. Units are available with or without built-in thermostatic controls. Wall-mounted thermostatic control is recommended when more than one unit is used in an area.

Installation instructions are provided by each manufacturer covering particular details of his unit. Surface-mounted panels require little installation work. Panels are usually equipped with an outlet box or knockouts in the back of the housing. Recessed mounting requires a little more work. All panels should be installed on outside walls, beneath windows if possible. Whether one large or two small panels should be used in a particular area depends upon the size, layout and furnishings of the area, related to the nature of radiant heat distribution. Objects should provide minimum obstruction to radiant heat waves. Wall-



RADIANT HEATERS

mounted thermostats should be located away from the direct path of panel heat output. Of course, thermal insulation of any interior to be heated must be completely adequate.

Installation of suspended or surface-mounted glass ceiling panels for radiant heating, either the heating unit type or the combination heating-and-lighting unit, corresponds closely to installation of fluorescent lighting fixtures. Details on the different units are given by the manufacturers.

Ceramic Panels—These units are similar to the glass panels, with the exception that the heating element consists of nichrome resistance wire embedded in a panel of special ceramic composition. Both wall and baseboard types of ceramic heating panels are available. Installation and application details on this type of radiant heater are almost identical to those described above for glass panel.

Asbestos Panels—This type of radiant panel consists of a resistance wire heating element hermetically sealed in and distributed throughout the area of a panel of asbestos with special binders. The wire element is terminated at two brass nuts which are integral parts of the panel. The resistance element can be controlled for various voltages and powers for a maximum surface operating temperature of about 400 F. The size and shape of the panel may be varied within limits not to exceed 1300 squares inches, with maximum dimension of not over 50 inches. The complete assembly of an asbestos radiant heating panel consists of a main housing which is mounted on the wall, the asbestos panel secured in the housing and wired to the circuit, and the louvered cover to prevent contact with the panel. Again, installation and application details correspond with those for glass panels.

Rubber Panels—These are radiant heating panels for ceiling mounting. They are fireproof panels ⅛-in. thick with a sheet of electrically conductive rubber sealed in. Aluminum and impregnated paper form the backing of the panel. Additional aluminum and paper layers cover the conductive rubber layer. A metallic conductor strip runs along each of two opposite edges of the conductive rubber layer. Voltage is applied to these strips, and current flow through the rubber layer produces uniform heat across the surface of the panel. There are no wires in the panel. Panels are made in three standard sizes: 3 ft by 4 ft, 4 ft by 4 ft, and 6 ft by 4 ft, weighing respectively 4.5 pounds, 6 pounds and 9 pounds. Panels are rated at 22 watts per square foot, for 115 or 230 volts.

Installation of rubber panel heaters involves mounting on the ceiling and connecting to electric circuits. Each panel has two small terminal blocks, one at each end of one of the 4-ft edges on the room side of the panel. Panels are installed with the edge containing the terminals placed at the junction of wall and ceiling. A small metal molding is provided to cover the terminals and to serve as a wireway. A single run of molding covers terminals and provides connection of several panels, in parallel, to the power supply. Panels are applied to the ceiling with a special adhesive and may be applied to plaster, plaster board and similar smooth ceiling surfaces, whether painted or not. The panels should be distributed symmetrically over the ceiling area. They may be painted with flat interior paints but should not be covered with any bulky materials which might reduce the heating efficiency. In some cases, rubber panels may be used on walls, if their output is not obstructed by furniture or other equipment. However, when mounted on walls, rubber panels act more like convection heaters than radiant heaters. Either line or low voltage thermostat control can be used with these panels.

Heating Cable—For space heating applications, electric resistance cable can be embedded in the ceiling to produce radiant heat. The cable is run back and forth across the ceiling area. When current flows through the resistance wire, heat is generated around the wire. This raises the

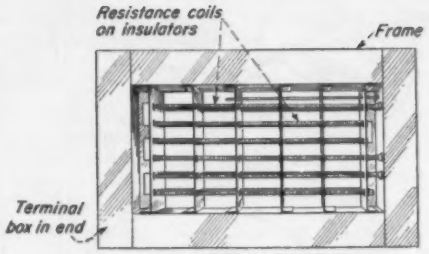
temperature of the ceiling plaster to about 110 F, and the entire surface of the heated plaster becomes a radiant panel sending heat down to the space. These rays, as in the case of rubber panels, heat the floor and other objects in the room, setting up convection heating at the heated surfaces. A heating cable ceiling installation produces about 70% radiant heat and the balance as convection heating.

Installation of heating cable in plaster involves stapling the cable (or attaching as instructed) to the ceiling lath and covering with plaster. The non-heating leads of the cable are brought from the edge of the ceiling down in the wall to the wall-mounted control device. Cable length must never be altered. Detailed instructions on installation are provided by the manufacturers. Care should be taken that the cable is not damaged in mounting or covering with plaster. Heating cable should be used only with non-metallic fire-resistant lathing and non-insulating plaster.

Heating cables are also used for floor panel radiant heating systems in concrete floors. The cable is laid out and fastened to wood nailing strips on the rough concrete slab. A cement finish 1⅛ inches thick is poured and trowled above the cables. Cables can also be used beneath tile floors, embedded in grout. Where wet floor conditions exist, heating cable of lead-sheathed or other water-resistant construction should be used.

Resistance Heaters—These units are similar to the natural convection heaters, except that a high percent of the heat output is radiant heat. Basically, they consist of a red hot resistance element mounted in a reflector housing which directs the radiant output. The element and reflector is mounted in a main housing and the unit has a protective grille over the front.

Lamp Heaters—Several models of electric radiant heaters use infrared incandescent reflector lamps, either singly or in clusters. These units are designed for only local applications, particularly bathrooms, and off-season heating in small rooms.



DUCT HEATER

DUCT HEATERS

Duct heaters are designed for installation in ducts used with forced air circulation systems in residential, commercial and industrial buildings. These unit heaters consist of a frame which can be bolted or otherwise secured in air ducts, sheathed resistance heating fins or resistance wire coils mounted between the frame members. Elements are carefully spaced to provide free passage of air between them. Duct heaters are made to replace steam or hot water coils in central air conditioning systems and fuel-fired furnaces. They are generally very high capacity heater units, prime heating sources for large areas or buildings. They are also used as booster or supplementary heat sources in large office buildings where tenants require more heat than the central system can provide. In such cases, they are used with duct distribution of the warm air and have independent controls. Another application is in industrial plants where certain offices require heat when the main heating plant is shut down.

Blast coil heaters are made as package units completely wired for connection to the power system. Line terminals are marked and complete installation instructions are given by the manufacturer. Terminal boxes are large and readily accessible and knockouts are provided. Control switches, contactors and thermostats are parts of the installation as required.

Electric Heat and the National Electrical Code

PROVISIONS covering application and installation of fixed electrical space heating equipment are included in Article 422 of the 1953 National Electrical Code. The following is a resume of these provisions and the related code sections, using much of the language of the code itself.

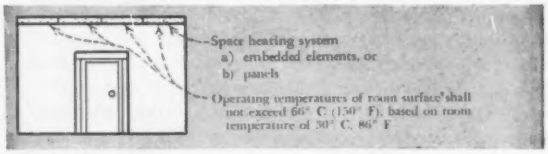
WHAT THE CODE COVERS

Section 4271 requires that equipment used in fixed electric space heating hookups be approved for such service. General requirements for appliances (secs. 4221 to 4262) apply to fixed heating equipment. Included in this equipment are electrically energized units, panels, space heating cable and central heating systems using electrical heating units. Electrical space heating systems employing methods of installation other than covered by sections 4271 to 4286 inclusive may be used only by special permission.

LIMITATIONS ON USE

Electric space heating systems are prohibited by section 4272—

1. Where exposed to severe mechanical injury unless adequately protected, and
2. In wet or damp locations unless specially approved for the purpose.



Section 4273 limits the operating temperature of room surfaces where electric heating is used.

Electric heating panels and cables shall be installed in their complete sizes or lengths as supplied by the manufacturer. Units must not be cut or otherwise altered in size or shape, and labels or nameplates must not be removed. All units shall be suitable for installation on approved wiring systems.

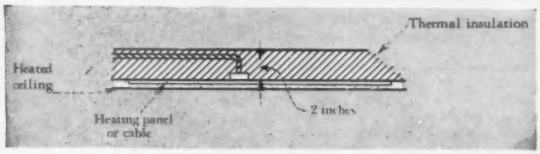
Heating cables shall have non-heating leads at least 7 feet long. These leads shall be of wire approved for

general use. Each unit length of heating cable shall have a permanent marking within 3 inches of the terminal end of the non-heating leads, indicating manufacturer's name or identification symbol, catalog number and electrical rating data. Lead wires shall be color coded as follows: 230 volts—red; 115 volts—yellow.

HEATING CONTROL

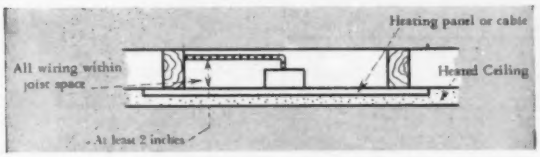
Thermostats and thermostatically operated switching devices which indicate an "off" position and which interrupt line current shall open simultaneously all ungrounded conductors in the "off" position. If there are no "on" or "off" positions, all ungrounded conductors do not have to be opened.

WIRING IN HEATED CEILINGS



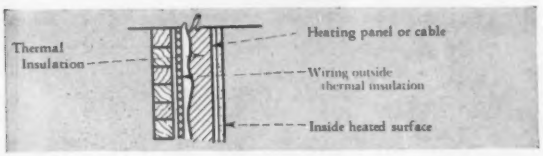
Wiring above heated ceilings and within thermal insulation shall be spaced at least 2 inches above the heated ceiling surface. Ambient temperature of the wiring is taken at 50°C. As a result, carrying capacities of wires must be corrected according to Table 1, Chapter 10 of the NEC.

Wiring above heated ceilings and over thermal insulation at least 2 inches thick requires no temperature correction.



Wiring above heated ceilings and within a joist space having no thermal insulation shall be spaced at least 2 inches above the ceiling. Ambient temperature is taken as 50°C; correction for current capacity must be made as in Table 1, Chapter 10.

WIRING IN HEATED WALLS



Where installed in exterior walls, wiring shall be run outside the thermal insulation. In interior walls or partitions wiring shall be installed away from heated surfaces. An ambient temperature of 40°C (104°F) is assumed as the operating temperature. Current capacity correction is given in Table 1, Chapter 10.

GENERAL INSTALLATION DETAILS

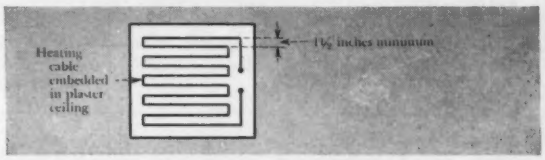
Electric heating panels shall not extend beyond the room in which they originate; a panel must be confined to one room. Heating cables shall not be installed in closets, over cabinets which extend to the ceiling, under walls or partitions or over walls or partitions which extend up to the ceiling. An exception to this rule allows single runs of cable to pass over partitions where the cable is embedded. NOTE: The foregoing shall not prohibit low-temperature heaters in closets to control humidity.

Heating panels and cables shall be separated at least 8 inches from lighting fixtures, outlets and junction boxes and 2 inches from ventilating openings or other openings and shall not be covered by surface mounted lighting units.

Embedded heating cables may be spliced only where necessary and only in an approved manner. The length of heating cable cannot be altered.

HEATING CABLES IN PLASTER

Heating cables shall not be installed in walls.



Adjacent runs of heating cable rated not more than 2¾ watts per foot shall be installed at least 1½ inches on centers when used in plaster.

Heating cables may be applied only to gypsum board, plaster lath and similar fire-resistant materials. With metal lath or other conducting surfaces, a coat of plaster—brown or scratch coat—shall be applied to cover the metal lath before the cable is attached.

The ceiling surface shall be finished with at least ½-in. non-insulating plaster or other approved material.

Heating cables in plaster shall be secured at intervals of not more than 16 inches. An approved method of stapling, taping or plastering or other approved means must be used in securing cable. Metal fasteners which straddle the cable shall not be used with metal lath.

Cables shall not make contact with conducting surfaces.

CONNECTION LEADS ON HEATING CABLE

Non-heating leads on heating cables shall be installed in accordance with approved wiring methods from the junction box to a location on the underside of the ceiling. Excess leads shall not be cut but shall be secured to the underside of the ceiling and embedded in plaster or other approved material. Enough lead should be allowed to reach the junction box with at least 6 inches of free lead within the box. Lead markings shall be visible in the box.

HEATING CABLES IN CONCRETE

Adjacent runs of heating cable rated not more than 2¾ watts per foot shall be spaced at least 1 inch on centers when used in concrete or poured masonry.

Cables shall be secured in place by non-metallic frames or spreaders while the finish is applied.

At least 1-inch spacing shall be maintained between the heating cable and metallic bodies embedded in the floor.

Cable leads shall be protected where they leave the floor. Rigid conduit, EMT or other approved raceway may be used to carry the leads from the floor to the junction box. Bushings should be used where the leads emerge.

DURING AND AFTER INSTALLATION

Embedded cable installations shall be inspected and approved before cables are covered or concealed. Cable shall be tested for insulation resistance after covering.

ELECTRIC SPACE HEATING (continued)

AVAILABLE EQUIPMENT

HEATER TYPES (See section on equipment for more complete descriptions.)	NATURAL CONVECTION HEATERS		FORCED CONVECTION HEATERS	RADIANT HEATERS					DUCT HEATERS
	Resistance Element in Air	Resistance Element in Steam or Hot Water Radiator	Resistance Element in Air	Resistance Element in Air	Glass	Asbestos or Ceramic	Conductive Rubber	Space Heating Cable	
	RATINGS AVAILABLE (Watts)								
A. Ceiling Panels or Units	...	...	1000	250 to 750	450 to 2500	...	For mounting on ceilings and walls Panel sizes available: 3'x4' 4'x4' 4'x6' at 17 and 22 watts per sq ft	For embedding in ceilings or floors Available in almost any length Wattages vary with length	For installation in heating and air conditioning ducts Available from .5 to 300 kilowatts
B. Wall Panels or Units, Surface or Recessed	250 to 8000	...	1200 to 5000	1000 to 3000	450 to 1500	750 to 1250			
C. Bracket or Pedestal Units, Commercial or Industrial	250 to 8000	...	15,000 to 60,000	...	...	...			
D. Baseboard Panels or Units	420 to 1400	...	...	...	750 to 3000	2880			
E. Floor Units, Recessed	3000 to 8000	...	...	...	...	...			
F. Standing Units, Fixed	703 to 2800	1500 to 3000	20,000 to 40,000	...	...	...			
G. Portable Units or Panels, Residential	1000 to 8000	1000 to 1500	800 to 5000	1000 to 1650	1000	1000			
H. Portable Units, Commercial or Industrial	1000 to 3000	...	1320 to 7500	...	...	...			
J. Explosion-Proof Units	1000 to 6000	2000 to 3000	...	...	...	...			

HEATER MANUFACTURERS

Letters in parentheses following manufacturers' names classify heaters in accordance with types A through J listed in above table.

NATURAL CONVECTION HEATERS
(Resistance Element in Air)

Adam Electric Co., Frank (B)
Arvin Industries, Inc. (G)
Bersted Mfg. Co. (G)
Cavalier Corp. (E, G)
Dominion Electric Corp. (G)
Economaster Sales, Inc. (G)
Emerson Electric Mfg. Co. (G)
Industrial Engineering & Equipment Co. (C, H)
Meier Electric & Machine Co. (B, D, G)
Paley Mfg. Corp. (B, D, F, G)
Post-Glover Electric Co. (C)
Titan Mfg. Co., Inc. (B, G)
Wesix Electric Heater Co. (B, C, D, E, G, J)
Westinghouse Electric Corp. (B, G, H)
Wiegand Co., Edwin L. (B, C, H)

NATURAL CONVECTION HEATERS
(Resistance Element in Steam or Hot Water Radiator)

Burnham Corp. (F, G, J)
Electromaid Corp. (F)

FORCED CONVECTION HEATERS
(Resistance Elements in Air)

Arvin Industries, Inc. (G)
Bersted Mfg. Co. (G)
Broan Mfg. Co., Inc. (B)
Dominion Electric Corp. (G)
Economaster Sales, Inc. (G)
Electromode Corp. (B, C, F, G)
Emerson Electric Mfg. Co. (G)
General Electric Co. (C, G, H)
ILG Electric Ventilating Co. (C)
LaSalle Products, Inc. (B, G)
Markel Electric Products, Inc. (B, G)
NuTone, Inc. (A)
Peerless Mfg. Corp. (B)
Post-Glover Electric Co. (C)
Thermador Electrical Mfg. Co. (B, C, G)
Wesix Electric Heater Co. (B, C, F, G, H)
Westinghouse Electric Corp. (H)
Wiegand Co., Edwin L. (B, C, F, G, H)
Wing Mfg. Co., L. J. (C)

RADIANT HEATERS
(Resistance Element in Air)

Cavalier Corp. (B)
Electromode Corp. (B, J)
LaSalle Products, Inc. (B, G)
Markel Electric Products, Inc. (B, G)
NuTone, Inc. (A)
Pryne & Co., Inc. (A, B)
Thermador Electrical Mfg. Co. (B, G)
Wiegand Co., Edwin L. (A, C)

RADIANT HEATERS (Glass)

Berko Electric Mfg. Corp. (B, D, G)
Continental Radiant Glass Heating Corp. (B)
Electriglas Corp. (A, B, D)
Electromaid Corp. (G)

RADIANT HEATERS
(Asbestos or Ceramic)

Heatmore Inc. (B, D, G)
ThermoRay Corp. (B)

RADIANT HEATERS
(Conductive Rubber)

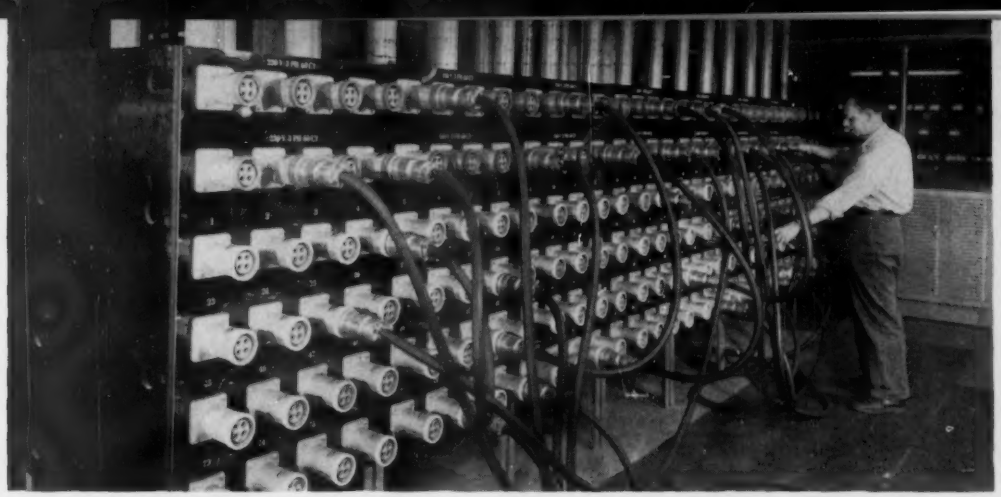
United States Rubber Co.

RADIANT HEATERS
(Space Heating Cable)

Ceilheat, Inc.
Continental Electric Equip. Co.
Electric Heating Products, Inc.
Electromode Corp.
General Electric Co.
Meier Electric and Machine Co. Inc.
Nelson Electric Mfg. Co.
Roberson Co., L. N.
Sunwarm, Inc.
Tennessee Plastics, Inc.
Wesix Electric Heater Co.

DUCT HEATERS

Electromode Corp.
Industrial Engineering & Equipment Co.
Wesix Electric Heater Co.
Wiegand Co., Edwin L.
Wing Mfg. Co., L. J.



DISTRIBUTION PLUGBOARD has 100 receptacles, permitting the connection of any one of a hundred testing stations with a variety of voltage levels, ac or dc, or with ac at any desired frequency. Board is primarily served by 4 transformers, an m-g set and a frequency converter.

Plugboard Permits Circuit Juggling

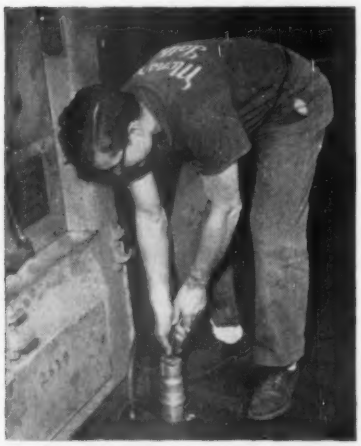
Selection of power having numerous voltage-phase combinations for research and testing purposes is possible with flexible connections.

DISTRIBUTION of power at several voltages or with other varying characteristics for research, testing or special manufacturing purposes can be facilitated through the utilization of a plugboard similar to one installed for The Monarch Machine and Tool Company, Sidney, Ohio, as part of their recently-completed modernization and expansion program. This board is primarily served by four transformers, a motor-generator set and a frequency converter; these equipments collectively providing several voltage levels in both ac and dc; 1-, 2- and 3-phase ac, plus several frequencies commonly used in various sections of this and foreign countries. This variety of power was called for, in this instance, for testing lathes being produced for overseas as well as for domestic consignment; the various power combinations including 3-wire 3-phase or 4-wire 2-phase ac from 25- to 60-cycles between 150- and 750-volts, plus a wide range of dc.

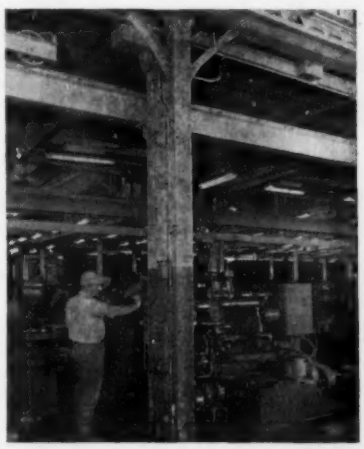
The power desired is routed to underground feeders by means of 4/c No. 2 flexible rubber-sheathed plug-in connection cables at the main 100-receptacle distribution board and, at the separate assembly and test stations, the power is again transmitted through recessed floor outlets and connection plugs provided for that purpose. Additional floor outlets at these individual assembly and testing stations also provide single-phase 110-volt ac at all times to power electrical hand tools.

In this same modernization program, flexibility of 440-volt power distribution for manufacturing equipment was furthered through the use of an overhead aluminum plug-in busduct system, and a wood-block flooring which can be removed to permit the local routing of branch circuits, then replaced over them, thereby permitting the relocation of machines when and if required, yet always maintaining the floor area clear of cables and otherwise unobstructed. These branch circuits are run in conduit, dropping from plug-in devices down along the building column closest to the machine to be powered, then run out to the machine with the circuit placed beneath the wood-block flooring.

This electrical installation was the work of Monarch's plant maintenance crew, under the direction of electrical engineer, Charles Wheeler.



FLOOR OUTLETS at each test station bring various combinations of ac and dc service to the various working areas. Also available at all times is single-phase 110-volt ac for electrical tools and incidental power.



POWER FOR MACHINES is easily brought down building columns from overhead plug-in aluminum busduct, then carried beneath wood-block flooring, keeping the area free from exposed conduit or cable drops.

FLOODLIGHTING reveals beauty of National Archives Building's classic design nightly from dark until 10 p.m., attracts attention of visitors in the nation's Capitol to this National Shrine.

National Archives Floodlighted

THE National Archives Building in Washington, D. C., facing famous Constitution Avenue and The Mall in the heart of the nation's Capitol City, has been effectively floodlighted. It is the sixth public building in Washington to be so lighted, and it's classic design exterior is illuminated every night from dark until 10 p. m. This has been done to focus attention on the repository for the Nation's priceless documents and permanent federal records, and to accommodate visitors to the building's Exhibition Hall where the Declaration of Independence, the Constitution, and the Bill of Rights are prominently displayed.

This imposing example of classical architecture, with its 72 Corinthian columns, was the work of famed architect John Russell Pope, who made provisions for its floodlighting in 1931 when the block-long structure was built. These provisions consisted of 162 inter-connected brass boxes, five inches square by four inches deep, installed at three different levels where floodlights would be required. Each box was equipped with a brass cover plate containing a half-inch drilled and tapped hole in the center. There were 96 of these boxes in the outer wall of the moat, 32 in the 13th tier wall, and 34 in the 20th tier wall.

Specifications for this floodlighting project were prepared by D. C. Freeman, Chief, Electrical Section, Region 3, General Services Administration, and competitive bidding on the work was then sponsored by GSA. Two electrical contracting firms in the Washington area, Roy Lee and H. P. Foley Companies, were awarded the work. The Lee firm was awarded the work for the three levels of the building's front, or Constitution Avenue, side and the Foley firm was similarly awarded the work for the three remaining sides.

A stringent deadline of six weeks was set for completion of all work, which meant the job must be completed by August 29th, in time for Archives and American Legion officials to floodlight the building for the first time at special ceremonies during the Legion's Convention in Washington this summer.

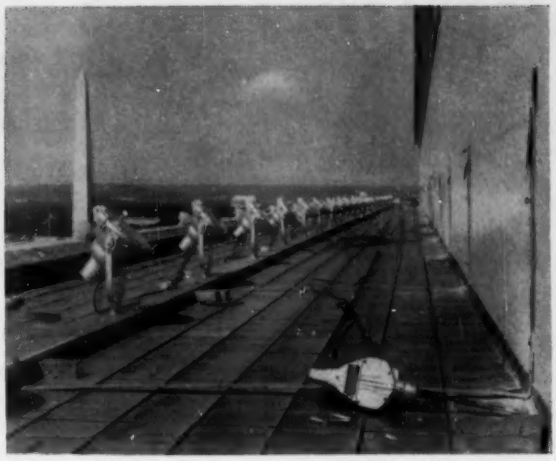
The two electrical contracting firms anticipated the unique procedure of following a conduit system already installed and waiting for use. They devised a means of cleaning clogged conduit, avoided drill damage to the building's irreplaceable Indiana limestone masonry, used specially mounted nonferrous fittings to prevent rust discoloration, and used 280 Crouse-Hinds floodlights which they concealed as completely as possible while still providing the maximum effectiveness in floodlighting.

On the front (Constitution Avenue) side of the Archives, much of the conduit installed in 1931 was clogged with masonry debris and dirt, as was also true to an extent throughout the job. To free these sections, the contractors used electric fused nitroglycerin caps, fastened by Scotch tape to the curl end of a fish tape. The caps were connected to a 6-volt flashlight battery by two No. 18 bell wires. Then, the fish tape was pushed through the conduit until it reached an obstruction. After the open end of the conduit was plugged with rags, the circuit was closed, igniting the caps. The resulting explosion blew out the obstructions.

Lighting specifications called for 126 wide-beam floodlights equipped with 750-watt lamps to be installed in the moat, and for 46 similar units around the building at the 13th tier level. Contractors used ADE-16 units at these two locations. For the 20th tier level, 104 300-watt floodlights, equipped with wide-beam reflectors and 100 degree spread lenses, were used. In addition, two 1000-watt narrow-beam floodlights equipped with G-40 lamps, were located at each corner of the front entrance side to illuminate the flag poles.

The building's 72 Corinthian columns are illuminated by floodlights located in the moat, with the exception of those bordering the front and rear

COLUMNS and lower walls are lighted by 750-watt Crouse-Hinds ADE-16 wide-beam floodlights installed on wall of moat around building, and connected to wall-recessed wiring.



WALLS above 20th tier level are lighted by 300-watt wide-beam floodlights equipped with 100-degree lenses. Units are mounted on specially impregnated redwood boards.

New floodlighting system reveals classic beauty of National Archives building nightly, focuses attention on this National Shrine where priceless documents and permanent records of the United States of America are preserved and displayed.

entrances. Because the columns at the rear of the building on Pennsylvania Avenue are mounted on a base approximately 20 feet above street level—an area inaccessible to the public—floodlights were installed behind the columns and the beams aimed straight up. Since the front side pillars on Constitution Avenue are openly exposed between the Exhibition Hall and the entrance steps, they are not illuminated. Two streetlight clusters flanking the steps provide light for visitors entering or leaving the main entrance at night.

Floodlights in the moat and on the 13th tier level were mounted identically. The cast aluminum trunion arms of each floodlight were supported by a non-ferrous plate, through which three stainless steel bolts were screwed into the limestone masonry. To avoid cracking or chipping, plate support holes were drilled 3½-inches deep with Carboloy-tipped tools. On the moat walls plates were located 10 to 12 inches above the existing brass outlet boxes. But on the 13th tier level, because of limited wall height, the floodlight base plates were set at the same level as the adjacent outlet boxes. Each floodlight outlet cord was fed through a brass water-tight cable connector into individual outlet boxes.

Mounting methods used on the 20th tier differed considerably from those employed on the lower levels. Here, because the floodlights had to rest directly on the roof and focus upwards toward the inner tier wall, special mountings were necessary. If support plates were bolted to the tile roof water leakage could spoil or damage the priceless records stored below. As a result, the 20th tier floodlights were mounted on specially impregnated 2- by 10-inch redwood boards supported by 2- by 4-inch blocks spaced every four feet. The boards ran the full length of the floodlight bank, and were rigidly held in place by a series of stainless steel straps bolted to the inner wall. Non-ferrous fittings were used exclusively to prevent rust stains.

FLOODLIGHTS at 13th tier level are 750-watt wide-beam type, and mounted to parapet wall with non-ferrous fittings to avoid rust stains.

This arrangement allowed the floodlights to be banked about five or six feet from the inner tier wall and spaced eight feet apart, except for the two extreme end units which were only four feet from the wall and the next adjacent floodlight.

Other than on the 20th tier level, the floodlights are paired only at the flag poles and at four special points around the 13th tier level. On that level, the tier roof connects with the corners of the front and rear entrance entablatures or triangular-shaped upper stories. At these points, banks of two floodlights cover the middle wall areas above and behind each entablature, wiping out shadows ordinarily thrown on the walls by the rising, steep-graded roofs of the entablatures.

The floodlighting system was designed so that a low level of brightness would obtain on the lower levels and increase in brightness at the higher points. The final result showed that this objective was achieved. The intensity averaged 8 to 10 footcandles on the lower walls lighted from the moat, 12 to 15 footcandles on the wall area lighted from the 13th tier level, and 18 to 20 footcandles on the top wall area lighted from the 20th tier level.

AT THE TEST BENCH–6

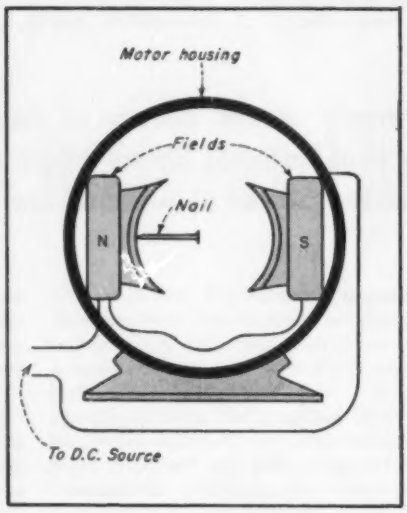
Testing Polarity

To assure proper and efficient operation of a motor, its fields must be connected for proper polarity. Tests to determine polarity of connections can be divided into two groups:

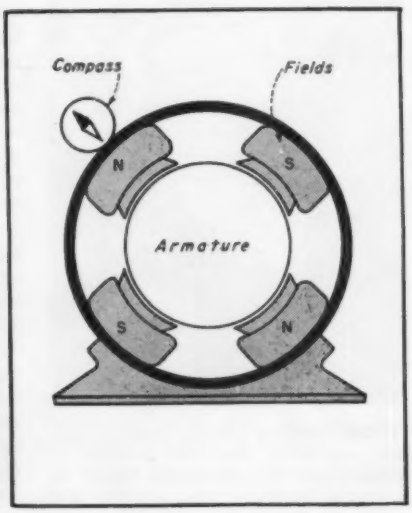
1. Tests on fields when motor is assembled.
2. Tests before fields are installed and the motor is assembled.

Both types of tests are included in the following experiments.

STEP 1. *Testing polarity of fields with a plain iron nail.* This is the simplest test for polarity. Because opposite polarities attract and similar polarities repel, if a nail is placed in the middle of a pole piece, it will stand up erect in the direction of magnetic flux between the two poles if the poles are of opposite polarity. A check of the field can also be made with a magnetic compass, either independently or simultaneously with the nail test, as shown in the photo. For this test, the fields are energized. If the poles are connected incorrectly, they will be of the same polarity, will repel each other, and the nail placed on the pole piece will fall to the bottom. These tests are usually performed after fields have been rewound and placed into the motor frame.

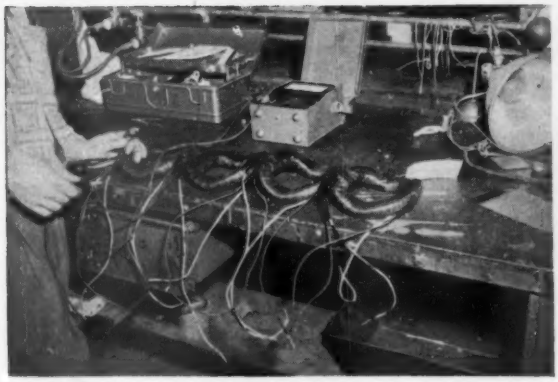


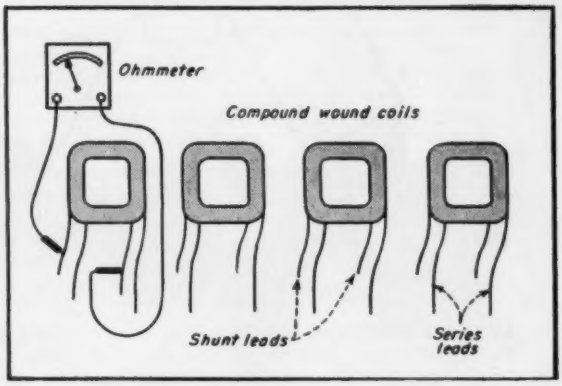
STEP 2. *Checking polarity of fields on assembled motor with armature in frame.* This check can be made simply and quickly with a magnetic compass. The armature must first be disconnected from the source to eliminate its effect on the polarity of the fields. The compass is first placed against the outside of the motor housing over one of the energized fields, as shown. Note deflection of the needle. By moving the compass around the contour of the housing, each successive field pole can be tested for polarity. If the poles are wound and connected properly, the compass needle will reverse itself when placed over adjacent poles, indicating that each pole is of opposite polarity to adjacent poles. If needle deflection does not reverse from one pole to an adjacent one, one of the poles is of incorrect polarity, and its connections must be reversed to change polarity.



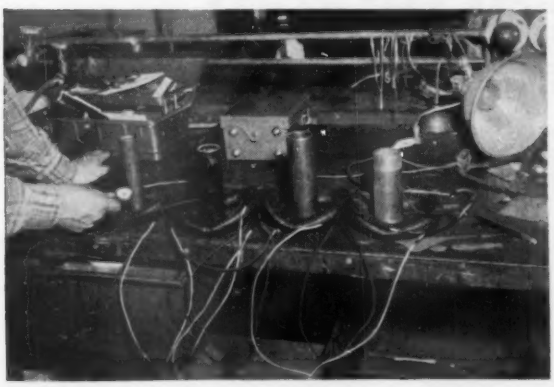
# of DC Motor Fields

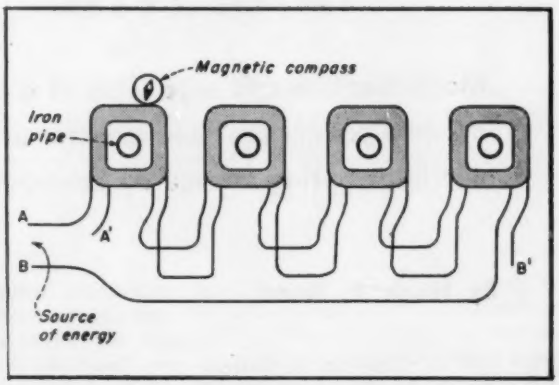
By Walter J. Prise,
Chief Engineer,
Queens Electric Motor Co.
Jamaica, N. Y.



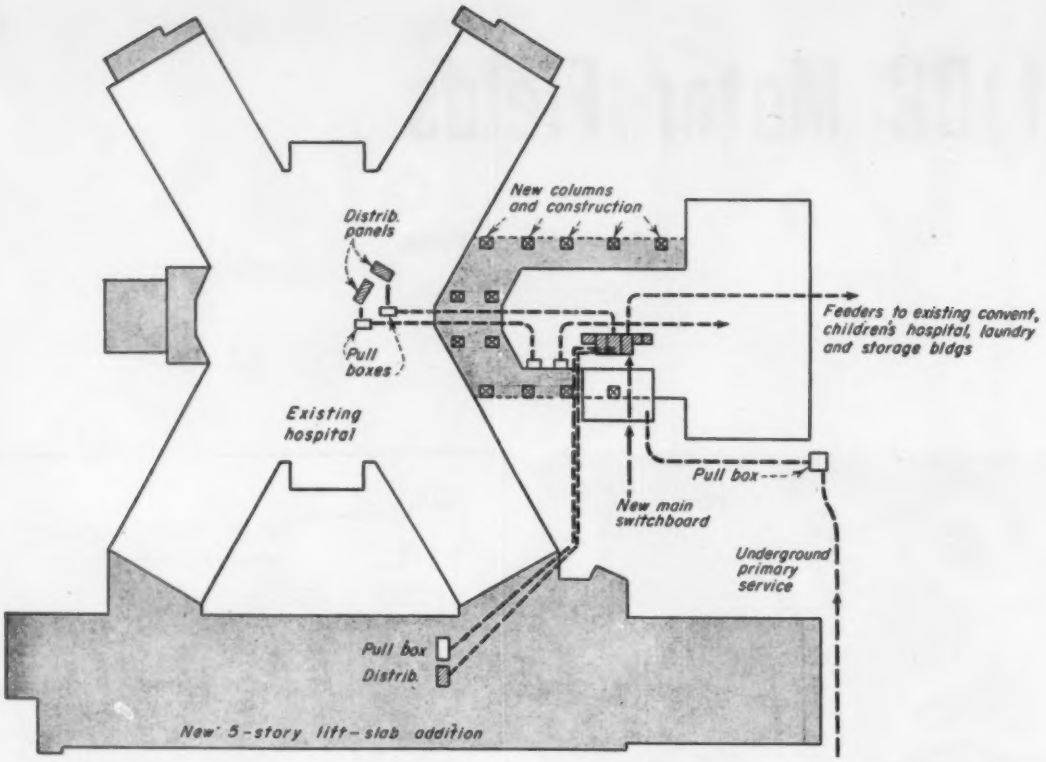


STEP 3.
Checking wound fields before they are inserted in motor frame. Often, to eliminate difficulties in the assembled motor, it is advisable to check field coils on the test bench. This is particularly true on multi-pole jobs. The fields can be laid out on the bench, and resistance of finished individual fields can be checked with an ohmmeter. Any large difference in resistances of similar coil windings indicates possibility that wrong size of wire or wrong number of turns was used on one of the windings. Photo and diagram shows ohmmeter testing on four compound-wound coils. Lead wires for series and shunt fields are usually made of different colored wires for easy identification. Shunt and series coils are checked independently.





STEP 4.
Connecting fields for proper polarity before mounting them in motor frame. As shown, short lengths of iron pipe are placed within each coil to concentrate magnetic field for test readings. This test shows checking of the shunt field. With the leads of the four fields connected as shown to an outside source of power, the magnetic compass is placed above one field and the needle deflection noted. The compass is then moved to the next pole, and the deflection is again noted. For each pole, the needle deflection should be opposite to what it is for adjacent poles. The series field is tested separately in the same manner. Leads A^1 and B^1 are then connected to the source of energy; leads A and B are disconnected. In all of these tests, it should be established that the series and shunt windings of each pole are of the same polarity.



LIFT-SLAB ADDITION, with gross floor area of 75,000 square feet, was recently erected at Mercy Hospital, Sacramento, California. This construction, plus several lesser increments and a general modernization of the former structures, necessitated the installation of a larger-capacity main switchboard, new distribution feeders and control centers, revamped lighting and numerous separate wiring systems.

PLANNED WIRING FOR

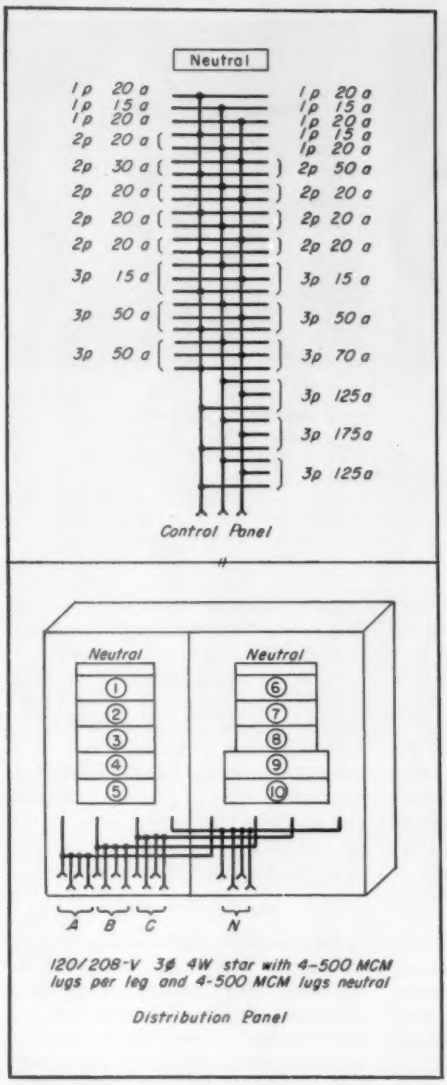
HOSPITAL EXPANSION

Modernization and expansion of a hospital in Sacramento, Calif., involved a 7-fold power boost and transfer of existing load to new equipment without interrupting service by contractors Wismer & Becker.

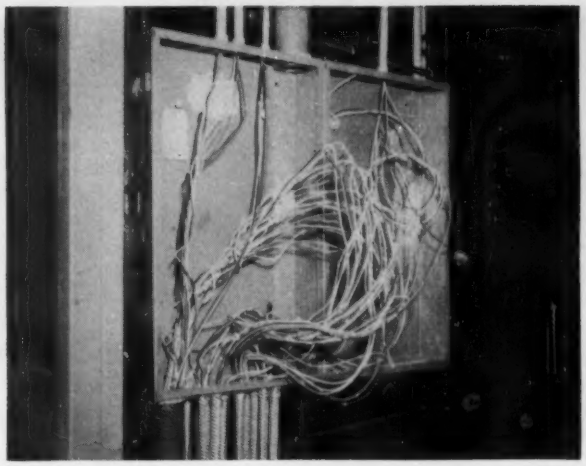
By Hugh P. Scott

OF UNUSUAL interest to electrical men is a unique wiring project rapidly approaching completion in Mercy Hospital, Sacramento, Calif. Covering a wide variety of installation problems, this job combines (1) five floors of lift-slab construction, (2) extensive rewiring and modernization of several previously-constructed buildings, (3) the shifting of a hot switchboard without interrupting the continuity of essential electrical services, and (4) the installation of a modern board and transformer vault to satisfy greatly-increased demands in this expanded hospital plant.

Each of the five lift slabs approximates 50 by 300-feet in area, but irregularities in shape, plus the development of some new construction methods, resulted in several novel deviations from standard erection procedure. (See "Lift-Slab Wiring Techniques", EC&M, June, 1954). For example, to reduce strains in slabs at the points where they protrude to connect with the main hospital building, several auxiliary columns were initially erected at those locations to establish additional jacking provisions during the lifting stages. Then, after all slabs had been raised to levels corresponding with floors of the older structure, these irregularly-shaped connecting wings were structurally secured to the main building, the then-redundant



SECONDARY POWER to distribution center (bottom) is carried via sixteen 500MCM cables (4 per phase leg and 4 neutrals) from main switchboard; 8 cables being carried in each of two 5-inch rigid conduits. Upper sketch shows details of bus structure in typical power panel, with 1, 2 and 3-pole breakers combined in a single unit, balanced across the three phase legs.



DISTRIBUTION PANELS are securely bolted to truss-type wall studs, then framed by expanded metal lath prior to plastering. Main risers are rigid steel full-weight conduit; EMT being used only for branch circuiting in dry locations. All wiring is color coded and banded with adhesive labels for proper identification. Panel gutters are liberally dimensioned to facilitate connection of circuit wiring.

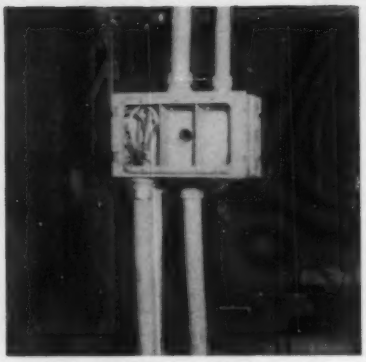
FLOOR SLEEVES were formed by placing sand-filled metal cans in position prior to the pouring of slabs. When cured slabs were raised, the loose sand dropped out and the cans were removed, leaving clean bores. Large-diameter steel risers, installed later, were supported at each floor level by bolted collar supports, the lugs of which were seated directly on the slabs.

columns were cut out by torch and removed, and the then-unused collar openings in the various slabs were capped. Another construction variation included the use of structural H-sections rather than tubular steel for building columns.

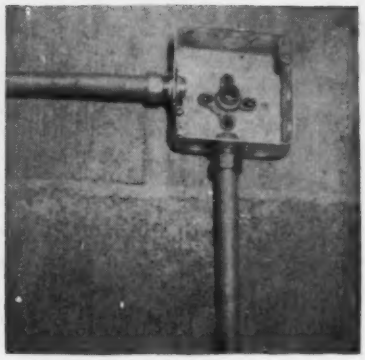
Basically, however, the lift-slab section of the work followed the pattern of (1) pouring all slabs at ground level, one directly on top of another, with wax coatings between adjacent slabs to prevent adherence, (2) installing upper and lower levels of reinforcing steel in each slab, then tying all slab-contained electrical components securely to these reinforcing rods to prevent shifting or slipping of conduits, hangers, outlets or ducts when concrete was actually poured, (3) raising the slabs to their proper elevations, using synchronized console-controlled hydraulic jacks atop each column, with threaded steel jack rods extending downward to engage lugs in the collars surrounding each H-section, (4) welding collars and plates to columns to hold slabs at prescribed elevations, then (5) constructing curtain walls of concrete, brick and glass to enclose the various floor areas.

With slabs poured at ground level (thereby eliminating the necessity for extensive scaffolding, formwork and hoisting of basic materials), considerable savings in both time and effort were effected during the initial building period, and overall benefits were obtained in speed, safety of personnel,

SLAB-CONTAINED CONDUITS were turned up at predetermined locations, then capped and surrounded by cans and loose sand prior to the pour. After slabs were raised into permanent position, these stubs were nippled up to wall boxes which in turn were tied to metal studs. Wall thickness permits back-to-back mounting.



THREE-GANG STATIONS in rooms of patients are partitioned to segregate 110-volt service, telephone jacks and wiring related to the nurses' call system. Corresponding cells of back-to-back bedside station boxes are connected by nipples, thereby permitting dual service from common branch conduit installation.



OUTLET BOXES mounted on concrete-block exterior curtain walls are positioned and tacked in place by nails, then additionally secured by screws and wall plugs. Curtain walls, extending between column-supported floor slabs, are subjected to no compressive forces except those minor ones created by their own weight.

construction simplification.

Also improved by this modern building method was the accuracy of the electrical installation for, with floor sleeves and inserts aligned while slabs were still in contact with one another, vertical positioning of riser openings was exact, resulting in a precision job.

In establishing these pipe sleeves to permit the later passage of risers through slabs, cylindrical forms made from 26-gauge galvanized steel were used, and they were dimensioned so as to permit at least a half-inch clearance between risers and the slabs through which they pass. After being secured in position, these sleeve cans were filled with dry sand to prevent concrete from filling passages during the pour. Then, when cured slabs were eventually raised into position, this dry sand dropped freely, the galvanized cylindrical forms were removed, and the sleeves remained as clean bores through the concrete.

Split Collars Hold Risers

When risers were later installed through these sleeves, they were supported at each floor level by means of split collar clamps, the bolted protruding arms of which were in turn supported by the slabs themselves. Cables within the risers are supported by split-wedge units.

As to conduits contained within the slabs proper, they are full-weight galvanized steel. Stubbed up or down where required, these conduits were either plugged or capped during pour to prelude entrance of concrete.

After slabs were in place and enclosing masonry curtain walls installed, branch conduits located on outer walls were secured either by powder-driven inserts (where approved by the inspector) or by pipe straps supported by standard expansion shields and screws. In no cases were wooden plugs used for this purpose.

All conduit used on the job (and EMT as well) was cut by power hacksaw, then reamed and threaded electrically; all these modern methods again contributing to the overall accuracy, precision and high standard of workmanship evidenced throughout the entire project.

Full-weight rigid conduit was the standard wiring medium through all slabs, for risers, or for runs underground (in which case joints were made up with red lead, then painted with asphalt as an additional seal).

Electrical metallic tubing was only used in dry locations, such as on walls and above suspended ceilings, and compression-type fittings were used to make up these runs. Flexible conduit was used only to connect motors or to connect recessed lighting fixtures with junction boxes incorporated in rigid branch circuits.

Contained within partitions between adjacent patients' rooms (partitions consisting of truss-type steel studs, metal lath and plaster) are 3-gang partitioned boxes with (1) duplex convenience outlets for 110-volt service, (2) jacks for telephone service and (3) switches for signalling nurses' stations. These bedside stations are located back-to-back (permitting the service of two rooms from the same location), and are interconnected by nipples to permit the twin boxes to be served by a single branch conduit.

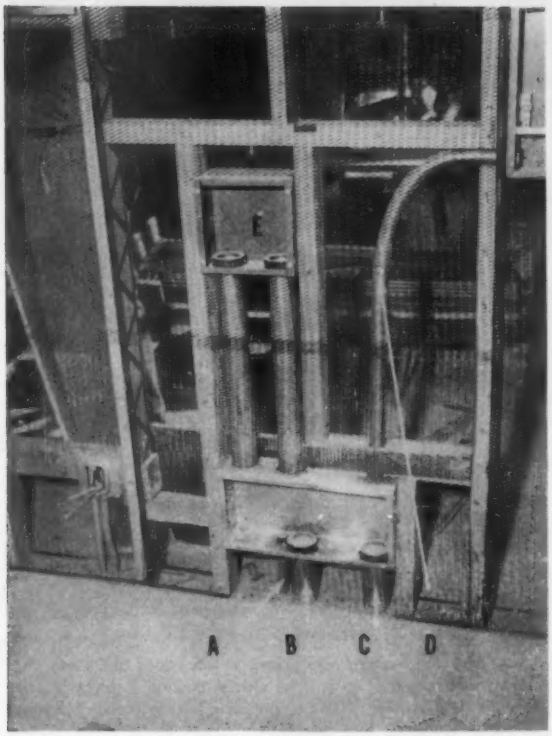
Jacks for the nurses' call system permit extension cords to be carried to patients' beds, while locknut buttons hold signals until they are reset manually at the signal-initiating stations, thereby insuring the personal visitations of a nurse. In the event that an extension cord is inadvertently pulled from the jack, the signal goes on in the same manner as a button-instigated call and, like the other signals, it can be shut off only by manually resetting it at the indicated bedside station.

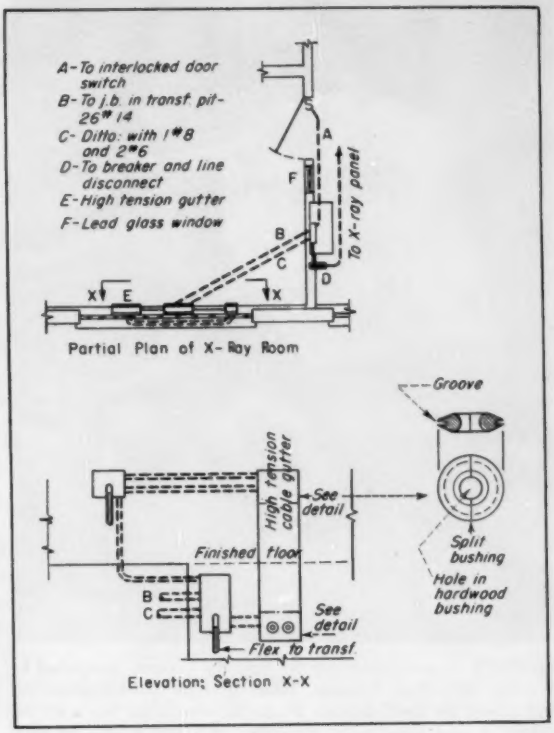
Nurses' Call System

The complete nurses' call system includes (in addition to these bedside stations) duty station annunciators (equipped with lamps, buzzers and cut-out switches), dome lights, separate wireways and dry-type 120/12-volt transformers for each floor. Call switches located in operating rooms are explosion-proof foot-operated units.

Another low-voltage (24-volt) installation in the hospital is a 2-board doctors' register system with provisions for 400 back-lighted nameplates. Register boards are located in the information room and also at the doctors' entrance, and names on the registers may be lighted when a doctor enters the hospital, or blacked-out when he leaves, by switches located at stations.

When these registers indicate that a doctor is in the building, the doctor may then be paged over a series of 5-watt permanent-magnet speakers that permit low-level but high-intelligibility announcements to be made from closely-spaced speaker grilles. This paging system also includes a control turret, volume indicating meter, master and area selection switches, 250-ohm dynamic microphone, amplifiers, racks





X-RAY BREAKERS and disconnects (D) obtain power from separate 120/240-volt 3-wire single-phase distribution system and basement-based transformer. All X-ray control panels (E) are located outside of treatment rooms, while additional protection for operators is provided by lead-glass viewing windows and interlocked door switches (A) that are normally opened when the doors are opened. Sub-slab conduits (B&C) carry power and control wiring to local floor-recessed secondary transformer pits, in which locations the covers of high-tension gutters are secured by means of special hardwood grooved split bushings.

and separate wiring raceways.

As insurance against interruption of incoming utility-supplied power, an emergency stand-by turbo-generator set is installed, with an automatic transfer switch for shifting the emergency load from one power source to the other when conditions warrant. The turbine for this installation is a 115-hp single-stage impulse-type unit operating with steam input at 100-psi. The generator is a 62.5-kva 50-kw unit, providing 3-phase 4-wire 120/208-volt power. Turbine and generator are linked through a flexible coupling.

Load-transfer switchgear consists of two separate 3-pole contactors, one for normal service, the other for emergency power. Contactors (interlocked so that both cannot be closed simultaneously) are operated electrically and held closed mechanically.

This emergency turbo-generator would automatically go into operation should the voltage in any phase of the normal supply system drop to a value of 70% for more than 2 seconds, and the load would be again reshifted when the utility supply returned to a 90% value and remained at or above that value for more than a minute.

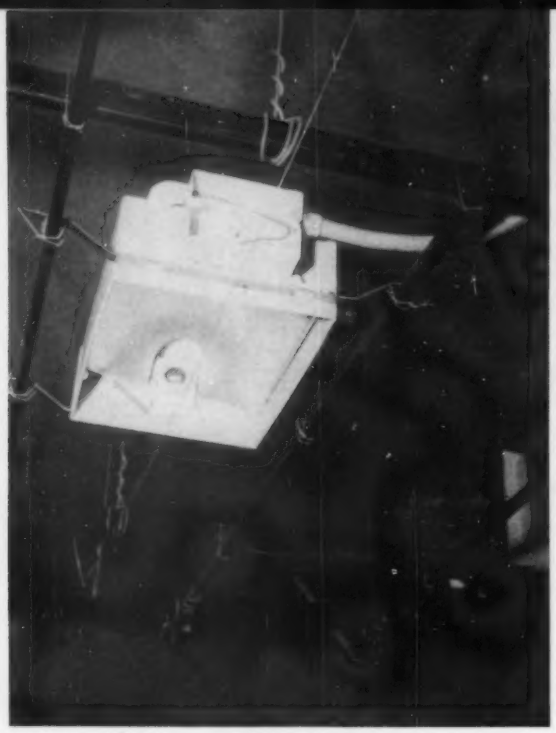
Besides serving emergency lighting, receptacles and critical motors in the hospital generally, this turbo-generator set serves isolated light and power systems in the various operating room hazardous areas. Power connections for these isolated systems are made in the main switchboard room on the load side of the automatic transfer switch which, in turn, obtains power either from the normal utility service or from the 3-phase emergency generator.

Isolating Transformers

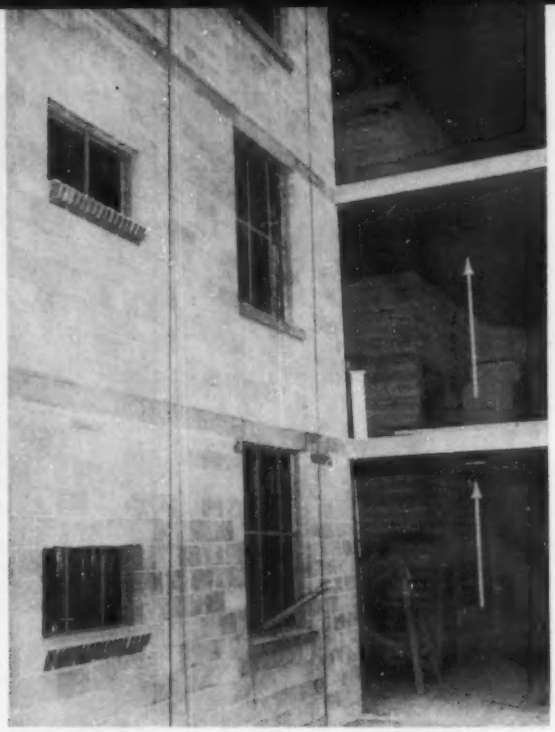
Each of the isolated systems (of which there are three) consists of a 10-kva isolating transformer (one-to-one ratio 120/120-volts with primary and secondary windings completely insulated from each other), a ground detector, signal and indicating lights, and a separate distribution panel. Ground detector units are linked with indicator lights within the operating rooms, so wired that a green light is on only when the system is free of all grounds, while a red light flashes (a buzzer also sounding a warning) in the event that the system is grounded.

Still another separate power system is installed in the hospital for X-ray equipment. Power for this installation comes through a separate X-ray transformer in the main vault; secondary power being 120/240-volts 3-wire single-phase. This system, also, is completely separate in nature, from the secondary side of the transformer through separate conduit runs to distribution panels and utilization outlets.

Throughout all of the hospital buildings, branch circuit wiring for power and lighting purposes is 12-gauge or larger, properly balanced between the various phases, color coded, and additionally identified in pull boxes and panelboard gutters through the medium of adhesive labels. Wire is Type R or T in all dry locations; Type RW or TW where run in conduits embedded in earth. All rubber-covered wire is solid when 8-gauge or smaller; stranded when 6-gauge or larger. Splices are made only where wiring is accessible, such as in outlet or pull boxes or in panel gutters. In all cases, branch circuit loading is kept at 70% or less of corresponding breaker ratings; with 10-amp switches controlling circuits of 600 watts or less, 20-amp switches controlling circuits handling between 600 and 1200 watts, and 30-amp switches



RECESSED incandescent corridor lighting fixtures, supported by brackets extending between T-bar grid for suspended-ceiling and served by EMT branch conduits, were lined up with the aid of a taut wire guide extending the full length of each hallway.



LIFT SLABS were raised into position, then concrete block curtain walls were added to enclose this structural addition to the hospital. Holes in the various slab wings (see arrows) permitted extra columns and hydraulic jacks to be used during lifting cycle. After slabs were in, columns were removed.

used for circuits carrying more than 1200 watts.

New Switchboard Assembled

Due to the addition of the 5-floor lift-slab wing plus the expansion of electrical services in formerly-erected units, newly-created electrical demands far exceeded the limited capacity of the original 400-amp live-front fused switchboard. Therefore, to handle these greater service requirements, a new 3000-amp main switchboard was installed in the basement of the original X-shaped hospital building. This board is a totally-enclosed dead-front 120/208-volt 3-phase 4-wire assembly, complete with 3-pole manually-operated distribution breakers. Its installation was complicated by two problems. First, the old board had to be moved a distance of 20 feet to permit the placement of the new board and a new structural column. And second, due to space limitations in the basement, low headroom, narrow passageways and the proximity of numerous pieces of heating, air conditioning and pumping apparatus, the new board had to be completely disassembled upon its arrival at the job site (down to separate cubicles, breakers and bus assemblies), transferred into the basement piecemeal, then reassembled in its ultimate position.

Moving the old board was further complicated by the fact that service in the existing sections of the hospital could not be interrupted; a factor necessitating the movement of the old board while it was still hot and connected to the utility vault.

To permit this shift, all feeders leading to or from the old board were first lengthened, and, to do this without interrupting service, two closely-spaced half-taps were established on each feeder, each half tap securing one end of the extra length of cable to be inserted in that line. Each original feeder was then cut at the point between the taps and the extra lengths of cable gave the required flexibility to permit the old board's movement.

With the old board out of the way, the new 3000-amp switchboard was then assembled in position and connected to a 3-phase 4-wire busduct structure extending through the reinforced-concrete wall of the transformer vault. This bus structure was supported from the ceiling by inserts, steel rods and trapeze hangers, while the passage through the wall was equipped with phase baffles, then sealed.

With the new switchgear finally in position and connected to transformer secondaries, new distribution feeders were installed between all breaker cubicles and all distribution panelboards (old ones in existing buildings as well as new ones in the lift-slab wing). Then, as a final step in this phase of the work, all disconnected conduits, wire, meters and equipment was removed from the premises.

Progressive Modernization

To complete the electrical modernization of Mercy Hospital's greatly expanded facilities, additional rewiring and relighting of the older units is planned for the immediate future. This project will be carried on, one floor and one wing at a time, with patients and hospital services being shifted from old to new or modernized sections as the work progresses.

Due to the great variety of work combined in this overall program and also due to the vital need for closely-coordinating activities of all trades and supervising agencies on the job, this construction and installation story reflects cooperation, planning and execution of a high order. It likewise reflects credit to architect Harry J. Devine, electrical consultant Carl Koch, and electrical contractors Wismer & Becker, all of Sacramento. Credit for a fine electrical installation should also include Frank Crum, electrical supervisor for W & B; Robert L. Crockett, electrical foreman on the job, and John W. Dutton, electrical inspector.

Magnetic Frequency Multipliers

for High Frequency Operation of Fluorescent Lamps

New frequency converter has unique circuit for increasing frequency of standard 60-cycle power to 360 cycles without moving parts or electronic tubes. Its availability may greatly affect the future of fluorescent lighting and associated equipment.

By J. H. Campbell* and E. G. Downie**

Operation of fluorescent lamps at frequencies above 60 cycles, and development of more efficient frequency converters, has been under research and study for the past several years. First reports[a] on these studies were made in 1947 by J. H. Campbell at the annual National Technical Conference of the Illuminating Engineering Society, and before other engineering groups during the same year. Mr. Campbell and his co-author of the report published here, both of whom have devoted much time and study to this subject, feel that sufficient progress has now been made to justify a new status report for the benefit of those electrical industry people who have been following and are interested in this subject. A unique circuit for increasing 60-cycle power to 360 cycles is described in this report, and the advantages and limitations of high frequency operation of fluorescent lamps are discussed. Availability of the new frequency converter device may have a far reaching beneficial effect on fluorescent lighting and associated equipment. A large commercial application now being installed will be described in another article soon to be published in this magazine.

Editor

A CONSIDERABLE effort has been made over a number of years to ascertain the extent of improvement in operation and economy to be gained by operating electric discharge lamps at frequencies higher than 60 cycles. The practical objectives of this research and development work are smaller, lighter, more efficient and lower-cost auxiliary equipment. Results show that this work yielded all of these anticipated advantages and many more. Meanwhile even greater efforts were made to improve the 60-cycle circuits and auxiliaries. That these efforts were successful is shown by the fact that starters have been eliminated for most lamp types, and instant-start[b] ballasts have been reduced in size, weight and cost. Further efforts in this direction face the law of diminishing returns unless radical changes in lamp design are made or a light source operating on an entirely different principle is developed.

Comprehensive tests[c] on lamps and ballasts over a wide range of frequencies have shown many advantages such as higher lamp and circuit efficiency, reduction of ballast weight and heat loss by as much as 90%, and the ability to load the lamp to higher or lower current for increased lumen output or lower brightness. Preliminary tests indicate this flexibility of operation may be accomplished without sacrificing lamp life. The success of the system for general applications depends upon an economic means for converting 60-cycle power to a higher frequency.

This study and development work has resulted in a long list of benefits which may be summarized as follows:

1. Reduced weight, size and cost of fluorescent ballasts.
2. Reduced fixture weight.
3. Increased ballast efficiency (less heat loss).
4. Simplified fixture wiring.
5. Increased lamp efficiency.
6. Increased lamp loading for more lumens per foot of lamp.
7. Reduced ballast noise.

At frequencies beyond 300 cycles it is practical to use a capacitor as a ballast for the lamp. This provides an interesting comparison, since 360-cycle capacitor ballasts weigh only 3 to 6 ounces and have losses of 1 to 3 watts. The same lamps when operated at 60 cycles require ballasts of 3 to 10 pounds per lamp with losses of 7½ to 25 watts. Actually this amounts to a transfer of most of the weight and loss from the fixture to the area where the frequency converter is located. The fixture manufacturers will then obviously have much more freedom in the design of the lighting equipment. An experimental 360-cycle 2-lamp industrial luminaire has recently been designed which weighs 7½ pounds compared to 40 pounds for an equivalent 60-cycle luminaire.

Frequency Converter

At the present time there are two practical methods for changing 60-cycle power to a higher frequency.

1. Rotating converters (motor generator sets 400 cycles or higher—sine wave).
2. Static converters (magnetic frequency multiplier—square wave).

The rotary converter is well known and has been in use since the turn of the century. In large sizes this equipment is low enough in cost to provide an economical means of conversion. A study is now under way to determine the requirements and possible gains in the use of rotary equipment for some industrial and office lighting installations.

The magnetic frequency multiplier was designed as a power supply for

* General Electric Co., Lamp Division, Nela Park, Cleveland, Ohio

** General Electric Co., Specialty Transformer Dept., Fort Wayne, Ind.

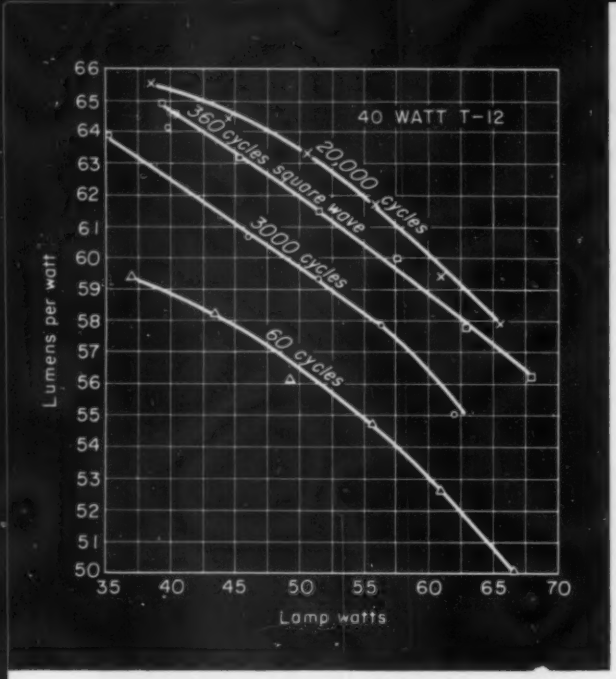


FIG. 1—Increased efficiency results when fluorescent lamps are operated at higher frequency.

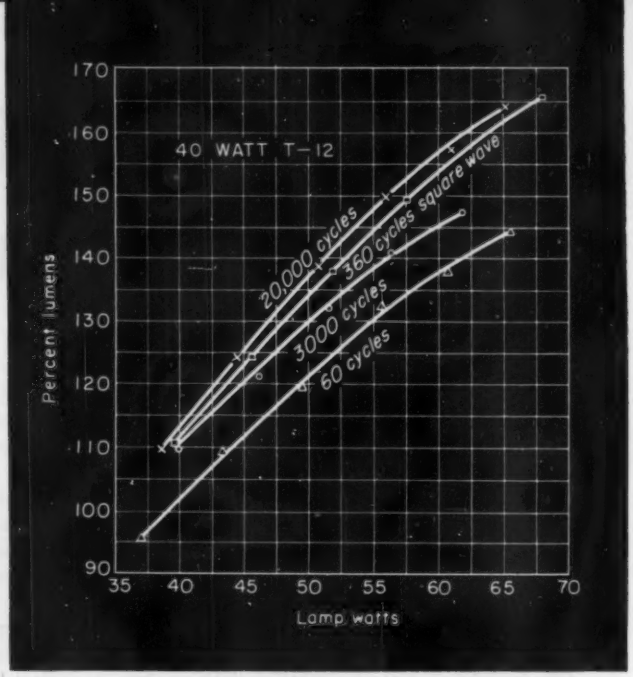


FIG. 2—Increased light output and higher wattages are obtained with higher frequency operation.

fluorescent lamps. It has no moving parts and can be treated as a transformer. A control on the panel makes it possible to regulate current to the lamp load for maximum flexibility. A unique feature of this circuit is the square current wave drawn by the lamp load. The output voltage, triangular in wave form, is applied to a lamp and capacitor in series, thus producing a square current wave.

Important lamp characteristics are shown in Figs. 1 and 2. These are efficiency and light output versus watts for several frequencies with a sine wave of current as compared to a 360-cycle square wave. These results show that at high frequency flourescent lamps may be operated at an increased efficiency at the rated lamp watts or at higher wattage and the same efficiency with a considerable increase in light output. Operation of fluorescent lamps on a 360-cycle square wave is equivalent to 7000-cycle sine wave operation and allows lower-cost distribution.

Any gain or loss in overall efficiency of the high frequency system will depend upon the losses in the converter as compared to the gain in lamp and ballast efficiency. With present information it appears that overall efficiency will be the same as 60 cycles with 5-kw converters and possibly 10% higher with 25-kw converters.

The Magnetic Frequency Multiplier

The practical operation of fluorescent lamps at higher than 60 cycles requires a dependable source of higher frequency power, at installation and operating costs which are reasonable in view of the advantages involved. Rotating frequency converters or motor-generator sets may be used, but they bring up maintenance problems not encountered in the usual building power distribution systems. Conversion of standard 60-cycle power to 360 cycles at a suitable voltage level and with preferred wave shape by means of a static device presenting no more installation and maintenance problems than a distribution transformer is certainly to be desired.

The magnetic frequency multiplier is such a device. With only magnetic, metallic rectifier and capacitor components, the multiplier converts 480 volts, 60 cycles, 3-phase power to 700 volts, 360 cycles, single phase, with automatic current limit and wide range of current control. The advantage of the multiplier's square or flat-topped wave of current into a lamp load is discussed elsewhere in this article.

Theory and Circuit

The basic circuit used in the multiplier is shown in Fig. 3. There are three elements: the frequency tripler stage (60-180 cycles), the frequency doubler stage (180-360 cycles), and the current limiting and controlling stage. The theory of operation of the tripler and doubler elements has been described in a previous paper*.

*(*L. C. Harriott, "Magnetic Frequency Conversion"; 1953 National Electronics Conference.*)

The tripler stage is made up of six (6) saturating transformers, (SX-1 to SX-6), a center tapped choke (LI), and selenium rectifiers (REC1) to supply saturating direct current. The transformers are not saturated by the ac applied voltage, but are saturated by the secondary dc which is many times the normal ac magnetizing current. One core is always saturated, and the voltages at the neutrals (NI, N2) become successively that of the three lines. The output voltage, which is one-half the sum of the six (6) secondary voltages, is a 180-cycle voltage of reasonably good wave shape. A bank of capacitors (CI) at the output of the tripler stage corrects for the highly inductive loading of the following doubler stage.

The second, or doubler, stage uses two saturating transformers (SX-7, SX-8), a choke reactor (L2), and a selenium rectifier (REC2). Low voltage ac excitation for the saturating current rectifiers is furnished to all stages by insulating step-down transformers (T1, T2, T3). Operation of the second and third stage saturating circuits from the first stage 180-cycle output (rather than from incoming 60-cycle power) insures proper starting sequence in the complete multiplier circuit.

As in the first stage, the transformers are not saturated by the ac applied voltage, but are saturated by the secondary dc which is many times greater than needed to bring the excitation over the saturation curve knee. The

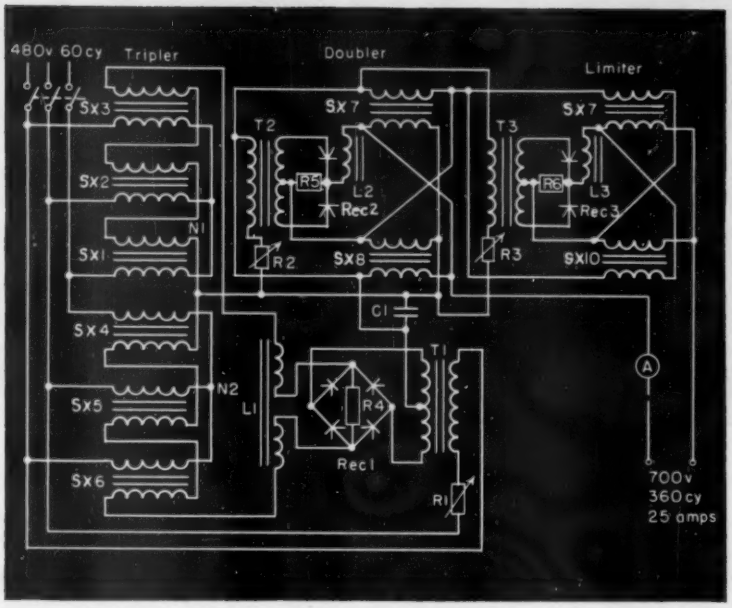


FIG. 3—Basic circuit in magnetic frequency multiplier has three main elements: frequency tripler stage, frequency doubler stage and limiter stage.

choke reactor, physically a little larger than either saturating transformer, keeps the dc saturating current essentially free of alternating current components. The secondary or output voltage is equal in magnitude to the 180-cycle input voltage, but by effect of the dc saturation, switches in polarity each half cycle, so that it becomes 360 cycles of peaked wave form.

A final stage is required, to provide control and proper wave shape of output current for best operation of a fluorescent lamp load. This stage is a series saturable reactor (SX-9, SX-10) designed and connected so that the windings carry ac load current and dc saturating current simultaneously. When the demagnetizing effect of the load current overcomes the dc saturation, the reactor windings begin to absorb voltage and prevent greater flow of load current. Adjustment of the dc saturating current, by varying the series resistance (R3) in the primary of the rectifier supply transformers (T3), thus controls the output current, which has the characteristic flat-topped or square wave shape of a series-connected saturable reactor with high control circuit impedance. The components of this limiter stage are very similar to those of the doubler stage, except that the saturating transformers have less core area.

FIG. 4—Magnetic frequency multipler converts 480-volt, 3-phase, 60-cycle power to 700-volt, 360-cycle, 25-amp continuous output.

Construction

Actual performance approximating the theoretical operating depends a great deal on the sharpness of saturation of the various saturating transformers. Manufacture of this device for sale has been made practical by the use of cold reduced 3% silicon steel in core assemblies which take advantage of its superior with-grain magnetic quality. The cores are stacked with U-punchings which have end sections twice the width of the legs, and with-grain end insert pieces, which provide a constant cross-section with-grain path around the magnetic circuit. The choke reactors are of more conventional E-I construction, but have internal air gaps for minimum noise.

The 5-kw magnetic frequency multiplier is enclosed in a steel case 31 in. wide, 25½ in. deep, and 56 in. high. The weight is 1,350 pounds. Input and output power lines, and lines to a power factor correction unit if required (see "Power Factor"), are brought in through conduit openings on the upper left side panel, and connections are made at the terminal board reached by removal of the front access plate. The circuit breaker type line switch and output current control knob are located on the upper front panel. The access plate also reveals auxiliary circuit fuses and adjustable resistors in the tripler and doubler stage dc saturation circuits. A meter indicates output amperes.

Cooling air circulation is provided by chimney action in the tall case, with inlet at the lower side and rear expanded metal covers, and outlet at edges of the top canopy cover. All components are mounted on a center frame, which is supported at top and bottom of the outer frame by rubber mountings. These mountings greatly reduce transmission of the high frequency magnetic vibration to the outer covers and to the supporting floor. Air transmitted noise may necessitate installation in an enclosed area in some quiet applications.

Performance Characteristics

The rated continuous output is 25 amperes at approximately 700 volts, 360 cycles, in a capacitive-ballasted lamp load. The current control permits adjustment of output current between approximately 13 and 30 amperes. The useful range may be limited by characteristics of the attached lamp load

[Continued on page 172]

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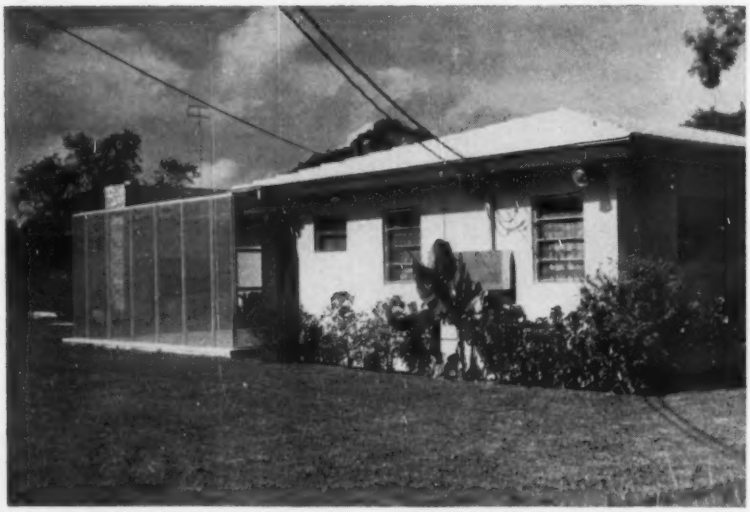
Showplace of Electrical Living

Spotlighting the ultimate in modern residential living, luxurious Progress House, Miami, Florida, previews the kind of house wiring and electrical application suited to present-day demands of progressive homeowners. William Hepburn & Co., Contracting Electrical Engineers, Miami, Florida, made the electrical installation.

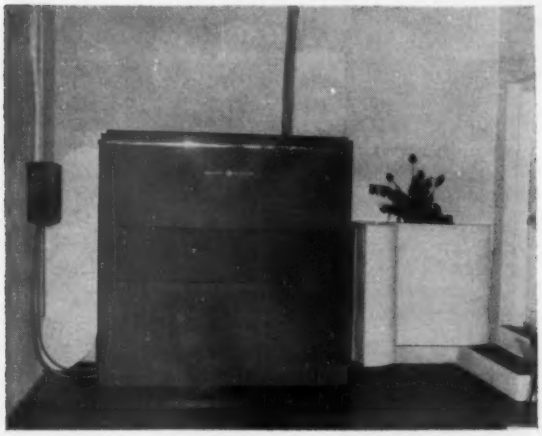
SE PANELBOARD on garage wall is fed by four SE conductors in 3½-inch conduit under floor from behind the house. On right is a 42-circuit branch CB panel fed by a 200-amp, 2-pole main breaker. At left, a 100-amp, 3-pole breaker feeds a heat pump unit; a 60-amp, 2-pole breaker feeds a range.



SERVICE DROP for Progress House comes down from a utility pole behind the house to a service head on 3½-inch conduit which runs into and out of the metering cabinet shown in the picture, then down under the floor of the house and up to the SE panelboard in the back of the garage. Utility transformer supplying the house is 220-volts 3-phase, delta-connected on the secondary with a grounded neutral center tapped from one phase leg. Four conductors come down to the house—three phase conductors and one neutral. One phase wire is a No. 1; the other 2-phase wires are 350MCM; the neutral is 4/0.

STEP LIGHTS are recessed in the stone pillars at the sides of the steps. These lights are controlled from inside the front door.

POST LIGHT on front lawn consists of a frosted-glass cylinder shielding an incandescent lamp. An outlet box fed by underground conduit is mounted to the post at its base.



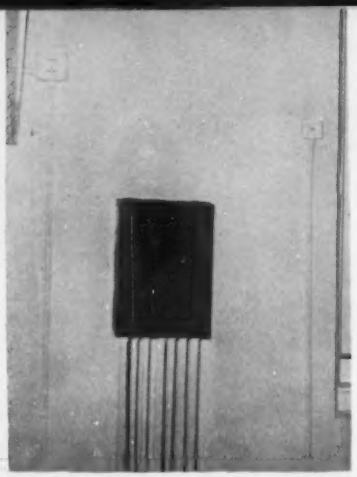
HEAT PUMP is installed in the rear of the garage and provides summer cooling and winter heating by reversing its refrigeration cycle. A single setting of the control thermostat operates the heat pump to provide heating or cooling as the interior temperature may require. The switchover to heat or cool is completely automatic. The compressor motor is a 5-hp, 3-phase unit fed through wall-mounted disconnect.

MODERN KITCHEN has an abundance of electrical outlets and circuits. Recessed fluorescent troffer provides general lighting; a fluorescent lamp behind the valance above the window provides local lighting for the sink area. Other equipment includes: an electric range with a deep fat fryer and an oven timer, a large refrigerator, a disposall in the sink and an automatic dishwasher.

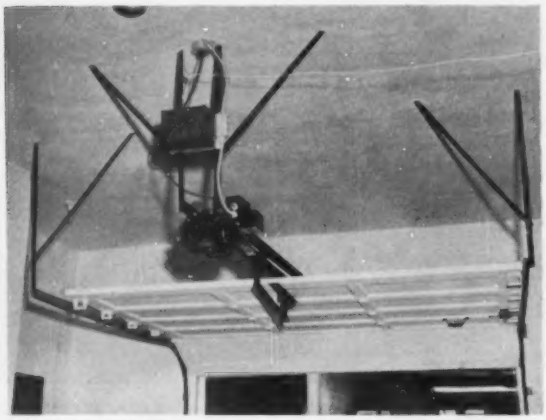
FRONT DOOR is lighted by a recessed incandescent box in the bottom of the roof overhang. The door chimes button is at the right of the door. Directly above it is one of seven stations of an intercom system. With this station, visitors can be questioned from two master stations inside.

UTILITY ROOM is also heavily circuited with plenty of outlets for flexibility. Room contains a 14 cu. ft. freezer (rear left), an automatic electric washer and an automatic electric dryer (both at right), an automatic electric ironer (left) and an 80-gallon automatic electric water heater (left).

MASTER BEDROOM is amply wired for lighting and receptacles. Decorative, retractible incandescent units are suspended from the ceiling at the sides of the bed. One of the master intercom stations, with selective connections to staff stations, is recessed in the wall at the right side of the head of the bed, permitting conversation with other members of the household anywhere in the house. Master station for relay switching is mounted alongside intercom.



RELAY CABINET on garage wall houses all the relays for the remote controlled, low-voltage relay switching system used throughout the house. Branch circuit switches which are not in the relay system are silent mercury switches.



DOOR OPERATOR for raising and lowering the garage door is motor powered and can be controlled by radio from a car, or by hand.

BATHROOM, one of three in house, has recessed fluorescent troffers mounted in the dropped ceiling along the built-in sink and table area.

OUTDOOR FLOODLIGHT (upper left) alongside garage door is a 150-watt, PAR-38 floodlamp in an enclosed reflector. Many such units are used around the grounds for functional and decorative lighting.

Modern Electrical Methods Triple Production

Electric degreasing tank, variable-speed conveyor, infrared baking oven and vaporproof lighting fixtures boost output in Cleveland plant.

MODERNIZATION can be credited directly with tripling production at the Dornback Furnace and Foundry Company, Cleveland, where the cleaning and finishing of furnace panels is facilitated by a new electric degreasing tank, an oval-shaped variable-speed overhead electric conveyor, a paint-spray booth equipped with vaporproof fluorescent fixtures, a 36,000-cfm exhaust system, and an 80-kw infrared baking oven.

Prior to this modernization program, furnace panels were hand wiped to remove oil and grease; a method that was time-consuming, non-uniform, frequently incomplete. Also, paint spraying without the benefit of an exhaust system was unsatisfactory, for fumes lessened plant cleanliness, air purity and safety. Lack of a conveyor necessitated more handling of parts, resulted in wasted space due to stacked panels. And, although the former drying arrangement utilized infrared lamps, the old hand-made oven (consisting of pipe racks and aluminum foil reflectors) was wasteful of heat and current, hard to regulate, bulky in construction and generally inefficient.

At the present time, the electrically-heated degreaser utilizes three 6-kw Chromolox immersion units, positioned an inch above the bottom of a 9-foot deep 6-foot wide tank. Vapor, maintained at a constant temperature of 320°, rises in the tank to a height of 7 feet, and oil-smeared panels are lowered into this atmosphere by means of an electrically-operated cage elevator. Immersion time is five minutes, then panels emerge as bare metal, devoid of all traces of oil or grease, bright and clean, ready for painting.

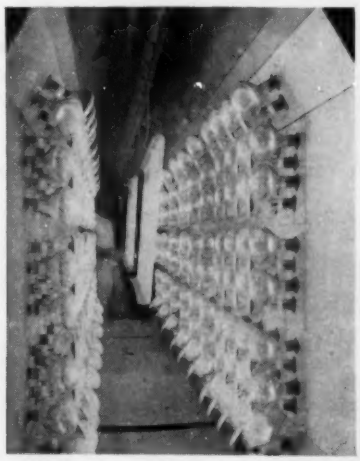
As the cage elevator raises panels from this degreaser, parts are suspended on the 210-foot-long chain conveyor and are carried slowly through the spraying booth where paint is applied smoothly, evenly and quickly by means of air pressure guns having feed lines connected directly to a central paint reservoir. Illumination of parts for critical inspection and detection of flaws is of a high order, with three 3-lamp vaporproof units mounted above the painter's head and inclined at a 40° angle in order to direct maximum light toward the horizontal plane beneath the moving chain.

From this spray booth, parts continue through a 22-foot-long oven, where an even 450° temperature is maintained when all of the 320 infrared Miskella 250-watt lamps are in operation. Lamps in the tunnel are arranged in 32 horizontal rows, 16 on each side, with rows separately circuited and switched for temperature flexibility. Lamps in adjacent rows are alternately directed to the left or right, thereby obtaining multi-directional radiation and permitting closer spacing of lamps than would otherwise be possible if the maximum diameters of each lens was in line. In addition, the two upper and two lower rows on each side are angled upwards towards the tunnel's axis, again concentrating heat in the area through which the painted panels pass. Complete finishing cycle is about 15 minutes.

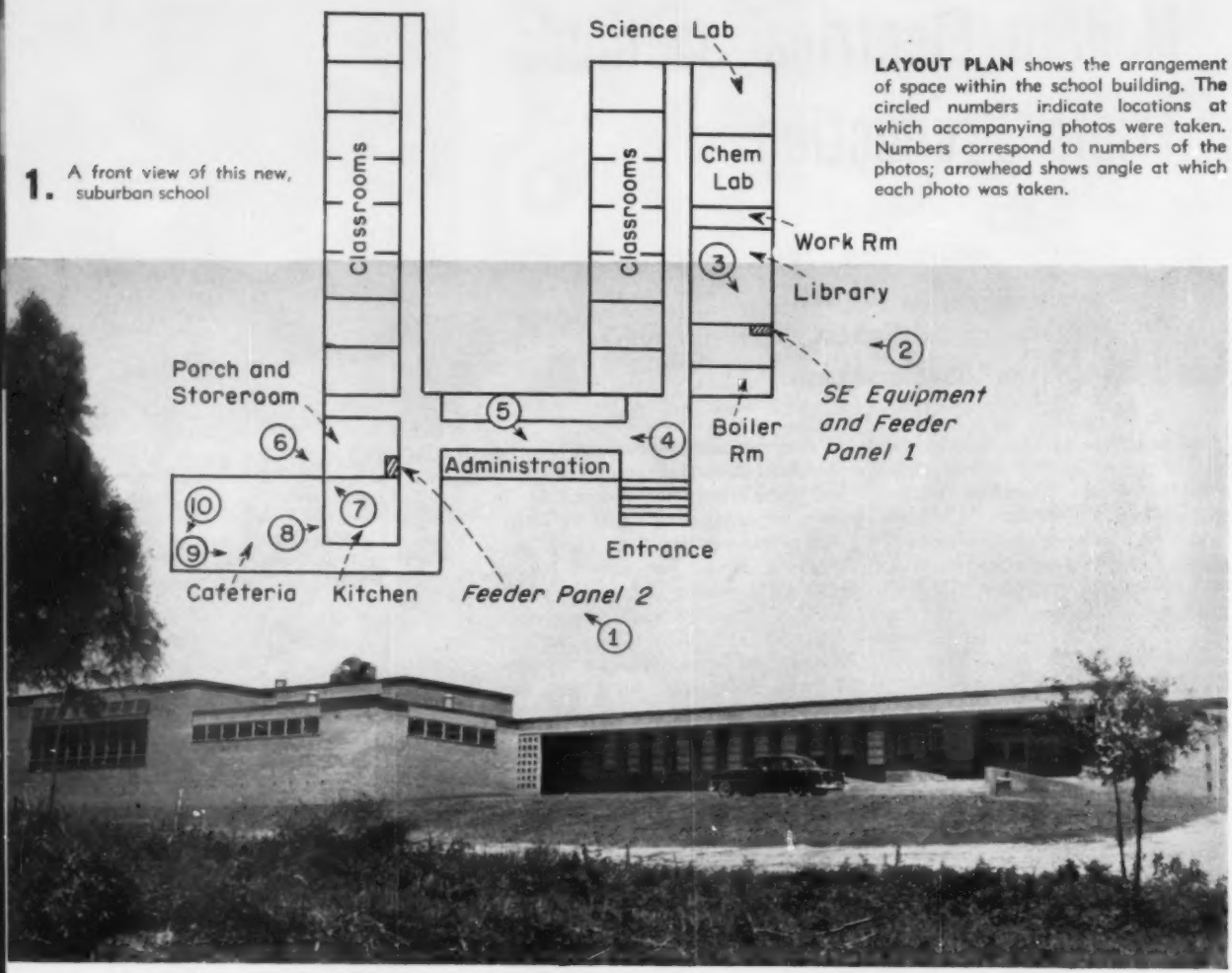
Installed by Dornback's own electrical maintenance crew under the direction of foreman Sutton Kinter, this mechanized finishing loop provides a far better product in a third of the former time, with less physical effort required, greater control, and negligible maintenance.

DEGREASING of furnace panels is accomplished in a 9-foot-deep tank equipped with three 6-kw immersion heaters. Parts are lowered and raised by means of an electric cage elevator hoist. Degreasing cycle occupies 5 minutes. Vapor is maintained at a constant 320-degree level.

SPRAYING is fast and even, with an abundance of illumination provided from three 3-lamp inclined vapor-proof luminaires for critical inspection and detection of flaws. Electric chain conveyor moves at 4 feet a minute. Fumes are removed by high-capacity exhaust.



BAKING of panels is in an 80-kw infra-red tunnel, in which 320 lamps are mounted in angled reflectors to provide an even 450-degree temperature for the 5-minute cycle required to advance products through the oven. Rows of lamps are separately switched.



1. A front view of this new, suburban school

LAYOUT PLAN shows the arrangement of space within the school building. The circled numbers indicate locations at which accompanying photos were taken. Numbers correspond to numbers of the photos; arrowhead shows angle at which each photo was taken.

Wiring a Small Town School

A roundup of details of the modern electrical system in Webster High and Elementary School

By Raymond F. Camus,
C & C Electric Co., Inc., Shreveport, La.

MODERN electrical practice is well represented in the new Webster High School and Elementary School for Negroes in the small southern town of Minden, Louisiana. Here, a clean, simple electrical distribution system runs throughout the one-level, expansive, all-brick building. Over-all, the electrical system serves 15 classrooms, a library, a work room, a chemistry-physics lab, a general science lab, offices, a kitchen and a cafeteria. Electrical details are shown in the accompanying photos; locations are marked on the plan.

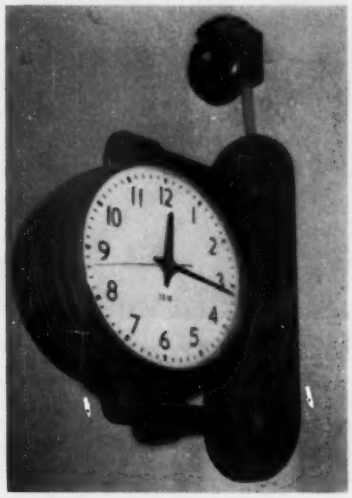
The complete electrical system is supplied from a 110/220-volt, single-phase, 3-wire, combination power and lighting service. Three 500MCM RH conductors pickup the service drop alongside a large service head on one side of the building. The 3-wire drop is made from a utility pole near the building. From the service head, the SE conductors are carried through the brick wall into the building, then down to a 400-amp main disconnect switch fused at 350 amps and mounted against one wall of the boiler room.

A feeder panel is mounted alongside the main disconnect switch and is coupled to it. Feeders originating at this switch and fuse panel include: three No. 2's in 1¼-in. conduit feeding individual branch circuit panels in the science lab, chemistry lab and the library; three No. 2's in 1¼-in. conduit, feeding individual branch panels in seven classrooms in the library wing of the building; three 500MCM's in

2. Service entrance conductors pick up 3-wire, 110/220-volt, single-phase service drop at rack alongside service head on one side of the building.

3. Library lighting is provided by eight, 4-lamp (75-watt, 96-inch T-12, 425 ma) suspended type fluorescent fixtures with eggcrate louvers. The units are mounted on 9-foot centerlines in the 38 ft by 30 ft interior. Four fixtures of the same type are used in each of the 20 ft by 30 ft classrooms.

4. Ten-foot wide corridor in administrative wing is lighted by seven, 200-watt, recessed, shallow, incandescent fixtures with diffusing glass shield. Square units are mounted on 12-foot centers in acoustical tile ceiling.



5. Secondary clock and program bell are mounted on wall in corridor. Bell operates on 24 vac.

3-in. conduit, feeding a second power and feeder panel in a store room adjoining the kitchen; three No. 1's in 1½-in. conduit, feeding a branch circuit panel in a janitor's closet opposite the administrative offices; and feeders to three small motors (1, 1 and ½ hp) in the boiler room and a 1 hp exhaust fan motor for the fume hood in the chemistry lab.

An emergency lighting panel is mounted close to the main disconnect switch and is tied into it. This panel feeds exit lights throughout the building and supplies the fire alarm system.

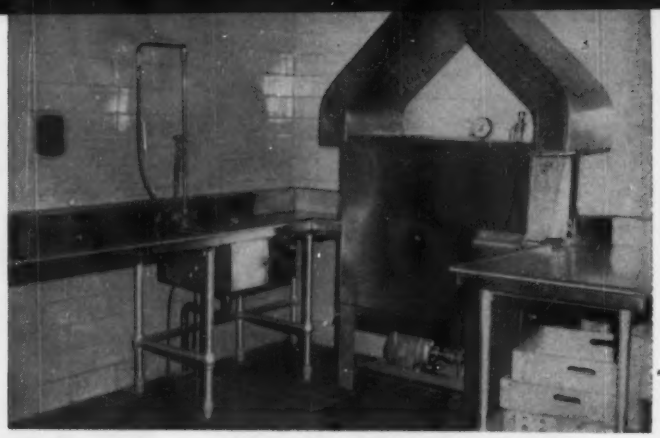
The second feeder panel, fed from the first, serves as a load center for the concentration of electrical equipment in the cafeteria and kitchen area. This panel, in a store room near the kitchen, on the opposite side of the building from the service equipment and the first feeder panel, is supplied in the floor of the building. From this panel, feeders fan out to lighting panels in classrooms on the same side of the building, to lighting panels in the kitchen and cafeteria and to motors for refrigerators, exhaust fan, cooler fan, food mixer and dishwasher.

Type RH wire was used for all feeders, except that type TW was used in floors. The smallest size of branch circuit wire used was No. 12. For branch circuits over 50 feet to the first outlet, No. 10 wire was used.

A system of empty conduits was installed for a public address system. A system of empty conduit was also installed for telephone service.

Throughout the building, a complete clock and bell system—program clock, secondary clocks, program bells and conduit and wire—was installed. The master program clock was wall-

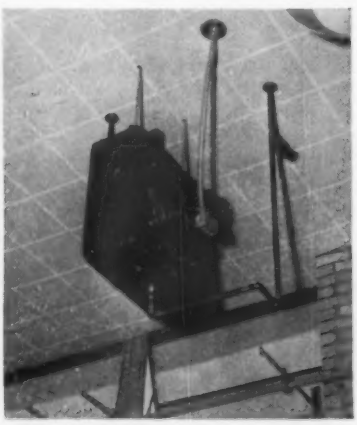
6. Truck dock and enclosed porch adjoin kitchen. Lighting units in canopy over dock and in ceiling of porch are 100-watt RLM dome ceiling type units with reflector and lampholder. Unit in canopy ceiling over door to cafeteria (at right) is 100-watt, recessed incandescent box with diffusing glass shield.



7. Dishwasher in corner of kitchen has 1½-hp, 220-volt, single phase motor mounted on rack under unit. Motor is fed by three No. 12's in ¾-in. conduit from power and feeder panel in nearby store room, through starter shown on tile wall at left. Connection to motor is made by a short length of flexible conduit coupled to rigid conduit in wall.

8. Lighting panel on wall of cafeteria controls lights and fan motors for unit heaters in the cafeteria. Panel is a circuit breaker load center and is fed by three No. 1's in 1½-in. conduit through the floor from a 100-amp, 2-pole switch, fused at 100 amps, in the power and feeder panel in the store room.

9. Cafeteria lighting is provided by 12, 500-watt, semi-indirect, luminous glass-bowl incandescent fixtures, with mogul bases and semi-rigid hangers. The units are mounted on balanced spacings on the high ceiling in the 60-ft by 40-ft interior.

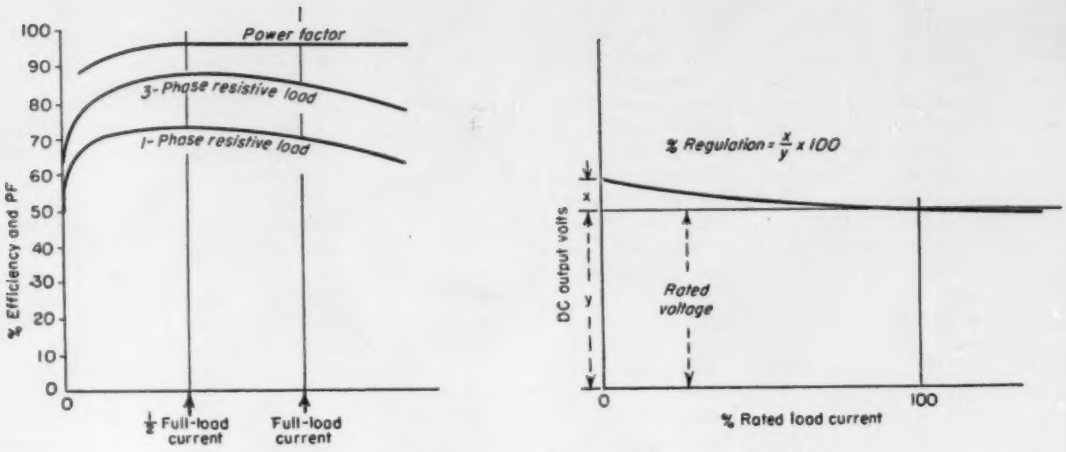


10. Unit heater is one of three such units suspended from the ceiling in corners of the cafeteria. Each unit has a 110-volt, 1/20-hp fan motor fed by flexible conduit from rigid conduit in the ceiling. Three heater units are on one 2-wire circuit from the circuit breaker panel in the cafeteria.

mounted in the principal's office. Secondary clocks were installed in the cafeteria and in the corridors, with program bells either at the clock locations or nearby.

The school fire alarm system is a local manual system of the closed circuit non-code type. Operation of any one station causes all the signal devices to sound continuously until the station has been restored to normal. The system is operated on 3-wire, 110/220-volt ac. Stations and alarm devices together with all control relays are operated from one incoming line to neutral, and the trouble bell from the other line to neutral. Alarm stations are flush-mounted, break-glass type and are located throughout the building. The system control panel contains the relays, fuses, terminals and resistors for operation of the system. The supervisory relay detects power failures and open-circuits on the system and operates a trouble bell. Wiring for the fire alarm system is No. 12 conductors in conduit to the various stations.

Architects of this school were Van Os and Flaxman, Shreveport, La. Landauer, Guerrero and Shafer, Dallas, Texas, were responsible for the engineering.



Selenium Rectifier Performance Curves

Selenium Rectifier Operation

Considerations of regulation, temperature, aging and maintenance in the application of industrial type selenium rectifiers.

By Samuel Heller, P. E.,
Chief Engineer, American Rectifier Corp., New York, N. Y.

REGULATION is the term used to describe the change in rectifier output voltage between no-load and full-load on the rectifier. Although this change is generally considered to be a voltage drop as the load increases, regulation is technically a percent rise in voltage as the load decreases from full-load to no-load. Percent of regulation equals the no-load voltage minus the full-load voltage, divided by the full-load voltage. The higher the percentage, the poorer the regulation. Good regulation means very little change in output voltage as the current output varies: it is therefore a low percentage. However, it is common to visualize regulation as the drop in rectifier output as the current increases to full-load. This voltage drop varies with the circuit used.

A normal convection cooled industrial rectifier unit has a voltage regulation of about 8%; i.e., there is an 8% rise in output voltage between full-load voltage and no-load voltage. A unit delivering 230 volts at full-load will provide 250 volts at no-load.

Fan cooling of rectifiers is generally used in units of 7.5 kw and over. This allows for larger output from fewer stacks, anywhere from 2 to 2½ times the output of normal convection (no fan) cooled units. The regulation of the fan-cooled type is poorer, however; and the greater voltage drop as the load is increased is a big problem in some applications. A fan-cooled unit properly designed usually has a voltage regulation of about 13%. Fortunately, a large part of the voltage drop occurs during the first quarter of the full-load. In many cases a partial load keeps the output voltage fairly steady.

It is possible to prevent voltage drop or even to cause a voltage rise upon loading of the rectifier. This can be done with magnetic amplifier control. A 300-kw unit for mine use was recently constructed with such control. There are no moving parts in the control; it contains magnetic equipment similar to that in the rectifier itself—a transformer and rectifier stacks. With this type of control it is possible to provide constant dc voltage output with as much as a 10% plus or minus variation in the input ac voltage. Constant voltage rectifier output, independent of load, is extremely useful in electrochemical processes. Magnetic amplifier control can also be arranged to provide constant-current output, an essential characteristic for many rectifier applications.

Control of Regeneration

When dc motors are driven above their rated speed, they generate a voltage back into the line above the line voltage. This effect is called regeneration. Heavily loaded elevators going down or empty elevators going up (when counterweights exceed the weight of the car and load), often cause regeneration in their driving motors. Elevators traveling less than five stories seldom gain enough speed to cause more than 2 or 3% regeneration. Machine tools with heavy rotating parts, automatic grinders particularly, also tend to cause regeneration under certain conditions.

Electronic tube and tank type rectifiers as well as selenium rectifiers cannot absorb voltage regeneration from dc motors which they supply. If the voltage feedback is high enough, serious damage to the rectifier may result. A safe limit of rectifier ability to with-

stand regeneration is 10% above the rectifiers maximum (idle) voltage. Usually if more than a 5% feedback occurs, some means is taken to minimize the effect. One method is by connecting a fixed resistor across the armature of the motor causing the regeneration. For an elevator, this is not wasteful, inasmuch as current is drawn from the rectifier only while the elevator is moving. But the rectifier must be large enough to take the full motor load plus the resistive load. Magnetic amplifier control and electronic means can also be applied to the problem.

Another form of voltage rise which can be harmful to rectifier equipment is that caused by the collapse of a field, such as a motor field or dc coil in a magnetic chuck or lift magnet. When such a field collapses, the magnetic flux cuts across the conductors of the field winding and an induced voltage "kick" is set up in the dc circuit. This "kick" can be eliminated by switching the field on the ac input side of the rectifier supplying it. If the load is switched "on" and "off" from the ac side, no discharge resistors, relays or other devices are necessary. Tests have shown that when the dc field supply is shut off from the ac side of the rectifier, only a very slight voltage rise may occur on field collapse. If the supply is shut off on the dc side of the rectifier, voltages as high as 25 or 30 times rated voltage may occur.

Age and Abuse of Rectifiers

Aging is the change that occurs in a selenium rectifier with the passage of time. Actually aging is the phenomenon by which the output voltage of a rectifier decreases with time. "Expected life" of a rectifier is that time up until the output voltage has decreased by 5%.

Tests indicate that if a rectifier is operated at its full rated current and voltage, aging will generally occur beyond 10,000 hours of use. Temperature has an effect upon aging and should be kept below 70 C (158F). If full load conditions are not applied, the 5% drop in output voltage may not occur for many times 10,000 hours. When it is important that output voltage be maintained constant, so-called "aging taps" are wound into the transformer to compensate for aging by changing the taps. For ordinary purposes, such taps are not used. For example, a 230-volt (dc output) rectifier with a 5% drop still puts out 218 volts—not a serious change in conditions for supply to ordinary machinery.

Under normal use, a well designed industrial rectifier should remain reasonably efficient for 60,000 hours or more. A rectifier may last much longer and usually does not fail completely, even though it becomes less efficient and may drop considerably in output voltage.

In particular, there are three chief enemies of a rectifier:

1. *Overvoltage*—Application of an ac input voltage in excess of the nameplate ac rating of the rectifier unit must be avoided. The maximum specified voltage should never be exceeded. Recently a 75-kw rectifier with a 230-volt dc output was shipped to a plant in which the voltage supply varied between 210 and 270 volts, 3-phase ac. Easily accessible bar jumpers were placed on the unit to provide tap changing as the ac voltage input varied. At the customer's request, the jumpers were hooked up for 210 volts. A few days after the unit was shipped, the customer phoned excitedly—"Everytime we push the button, sparks come out of the rectifier." They were applying 270 volts to the 210-volt tap. When the taps were changed, everything was satisfactory.

2. *Overloads*—Extreme continuous overloads can cause serious damage to rectifiers. Unfortunately, selenium stacks can take tremendous overloads without showing any visible signs of damage. Standard rectifier units are designed for 100% overload for 30 seconds, followed by 70% overload for six 30-second periods with 1-minute of no-load between periods. It is possible to design for 1000% overload for several seconds. Heavy continuous overloads may cause failure of connecting jumpers or soldered lugs or melting of surfaces on the selenium cells.

3. *Overheating*—Overloads actually cause destruction by overheating. Because overheating is a common cause of failure, cooling of the equipment is very important. In an ordinary convection cooled unit, proper use and care will prevent overheating. Generally, convection-cooled rectifier units require less cooling than would generators with equivalent outputs.

In fan-cooled or forced-cooled rectifiers, the air moved through the units should be as clean and as cool as possible. Units can be built, however, for continuous, efficient use in tropical climates where temperatures may run as high as 120F. Derating of output may be necessary under extreme high temperature conditions. For use where ambient (room) temperatures run around 140F and 150F, rectifiers require more stacks to compensate for voltage and current derating. At 140F ambient, a rectifier stack can carry only about one-half of its normal voltage and current.

Maintenance Factors

Adequate cooling of a rectifier must be carefully maintained to assure long life of the unit.

At partial loads, cooling presents no problems; but where loads are heavy and continuous—as in steel mills and mines—the rectifier should be placed where there can be no obstruction to its plentiful supply of clean air. Often, outside air is drawn through the rectifier and discharged to the interior. The best mounting position is about five or six feet off the floor where the air is generally cleaner and less laden with moisture or particles (especially in electro-chemical and plating plants).

On rectifier units above 5 kw, the fan is the only moving part, and it is generally good for about two or three years without lubrication. The magnetic contactor is usually in the air stream so that heating of coil and contacts is minimized.

On heavy duty industrial rectifier units, the use of very large stacks is avoided. Instead, a number of smaller stacks are arranged in parallel. This is done so that in case a stack should be damaged and fail, replacement will be an easy and economical matter. A recent incident demonstrated the value of such an arrangement.

A 50-kw unit was used in a steel mill to supply a machine tool. A lift truck, loaded with long solid bars of steel, was passing the rectifier. One of the bars slipped out of place and pierced the rectifier on the stack side. Two stacks were damaged; but because stacks were arranged in multiple, the damaged stacks were quickly cut out of the circuit. That rectifier remained in continuous operation for three months before the customer required replacement of these stacks.

A point to remember about rectifier maintenance is that the unit contains nothing which can wear out from idle use—no bearings, brushes or rotating windings. Many selenium units are left on 24 hours a day year after year without any visible wear.

Ratings of Rectifiers

Although the range of sizes and types of selenium rectifier units is extensive, there are basic sizes which represent the major part of the demand for selenium rectifiers.

Typical of 3-phase industrial selenium rectifiers are the following:

1. Fan-cooled, autotransformer type;

[Continued on page 247]

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- Substantial installation savings.

Integral breakers provide three-way protection because they are actuated by (a) coil load current; (b) temperature of the transformer; or, more commonly, by (c) a combination of both, since a rise in temperature increases the sensitivity of the breaker to overcurrent. The breakers are adjusted, however, for a coordinated time lag that permits non-damaging, short-time overloads without service interruption.

You'll find installed cost for transformers with integral breakers is substantially lower because there is only one unit to mount, one set of connections to complete the tie-in.

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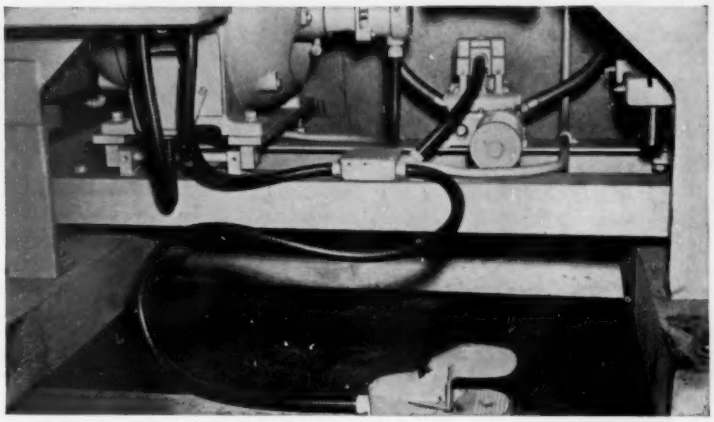
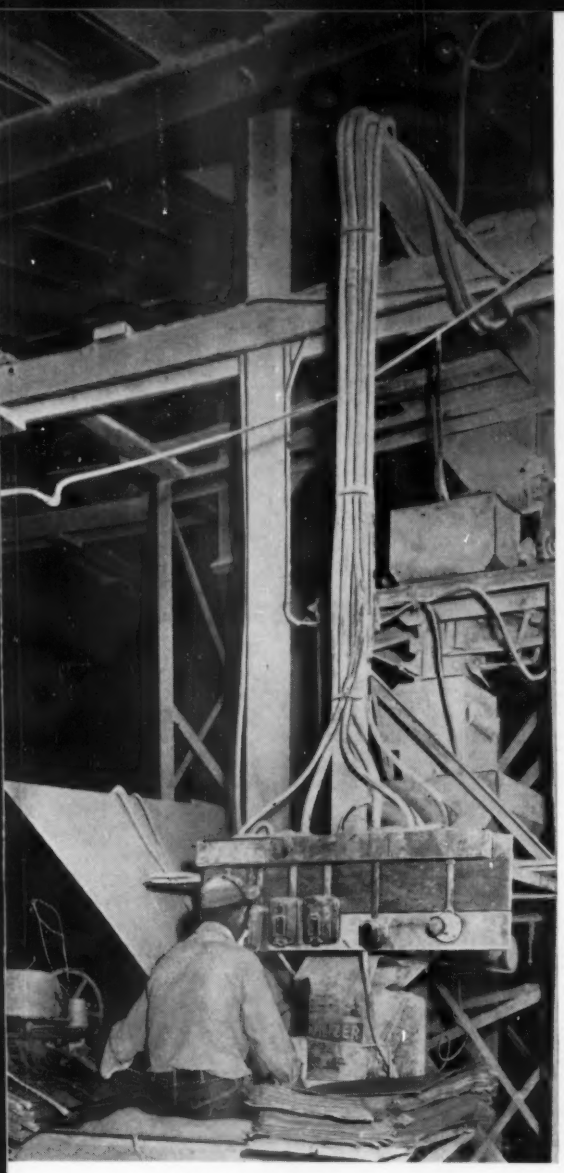


. . . on tube end-forming machines

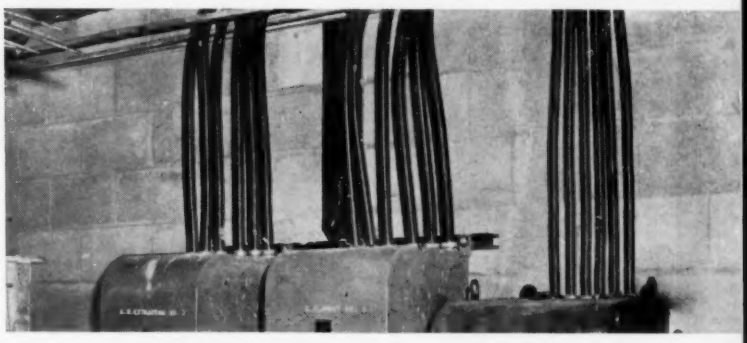
SEALTITE* Electrical Wiring Conduit is now standard equipment on all tube end-forming machines made by Vaill Engineering Co., Waterbury, Conn. Vaill found most customer specs are copies from J. I. C. – especially sections dealing with wiring in wet or oily locations. And SEALTITE Type E.F.† (Extra Flexible) meets J.I.C. requirements. "SEALTITE presents good contour-hugging appearance," says Vaill. Because it is *flexible*, SEALTITE absorbs vibration and protects wiring to moving parts. SEALTITE is easy to install, too. There's no threading. No cumbersome tools are needed. No special skill is required.

*Trademark †Pat. Applied For 54177WE



. . . in a fertilizer plant

Phosphoric acid in the form of dust quickly ate through neoprene covered wiring at a Midwestern fertilizer plant. Then SEALTITE Type E.F. (Extra Flexible) was installed to protect power and lighting wiring. Since then there's been no trouble. SEALTITE'S tough synthetic cover gives complete, permanent protection against moisture, oil, dirt, grease, chemicals and corrosive fumes. Lightweight SEALTITE comes in easy-to-handle coils and can be cut to required lengths.



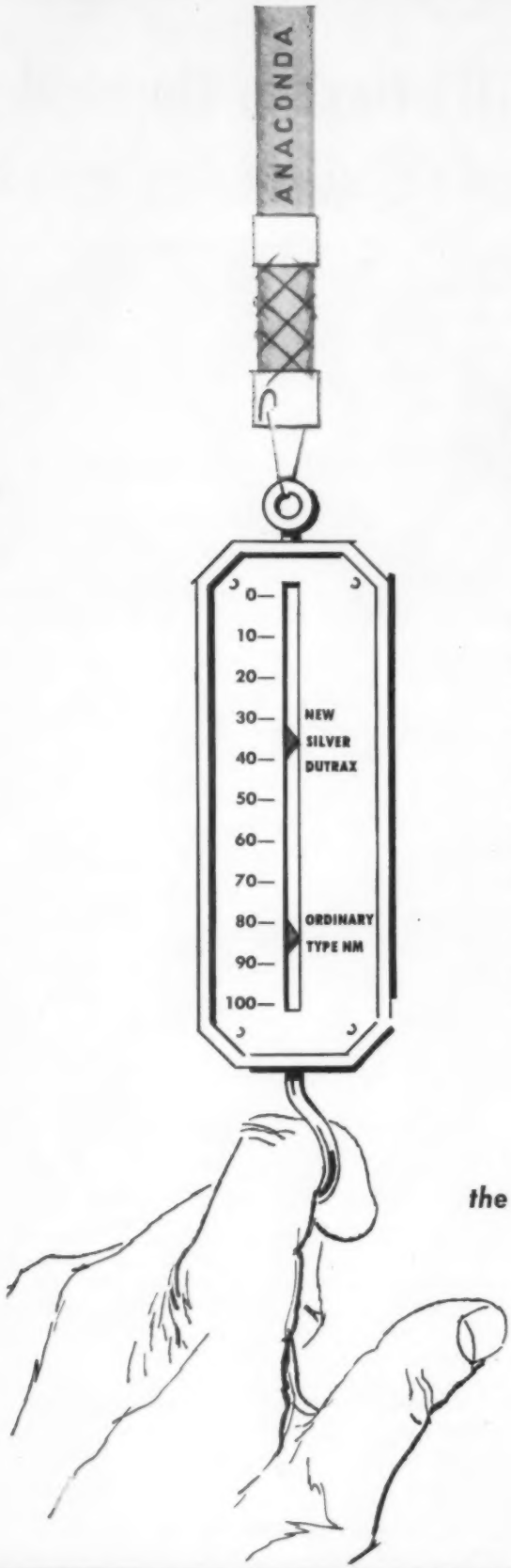
. . . in a yarn and knit goods dye house

American & Efird Mills, Mount Holly, N. C., knew electrical equipment in their new textiles dye house would operate under very severe corrosive conditions. At first, some rigid conduit was installed along with SEALTITE Type U.A. Acids in the atmosphere caused the rigid conduit to fail rapidly. But SEALTITE Type U.A. – the first *flexible* conduit to win Underwriters' Approval for use where exposed to moisture and mineral oils – took it in stride. Now all rigid conduit is being replaced with SEALTITE. American & Efird reports big time-and-dollar savings in installation, too.

FREE BOOKLET! Write today for your free copy of Bulletin UA-531, describing SEALTITE Types U.A. and E.F. and their applications. The American Brass Company, American Metal Hose Branch, Waterbury 20, Conn.

SEALTITE

flexible, liquid-tight electrical conduit—an ANACONDA® product



New

SILVER DUTRAX

nonmetallic-sheathed building wire

FISHES WITH HALF THE USUAL EFFORT

Silver Dutrax* speeds your work. It's clean to handle.

It won't become sticky . . . won't flake or peel.

You can fish it through joists with *half* – yes, half – the effort required by ordinary nonmetallic building wire.

Silver Dutrax won't soil your hands . . . lessens chances of marring walls.

Here's why: Anaconda Engineers have given this amazing Type NM building wire a revolutionary new finish —twice as smooth and absolutely non-soiling.

Want a sample to see for yourself? Ask your Anaconda Sales Office or Distributor. *Anaconda Wire & Cable Company, 25 Broadway, New York 4, N.Y.* 54458

*Reg. U. S. Pat. Off.

the right cable for the job

ANACONDA®

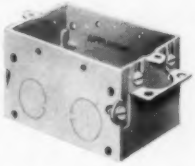
WIRE AND CABLE

FOR EVERYTHING ELECTRICAL . .

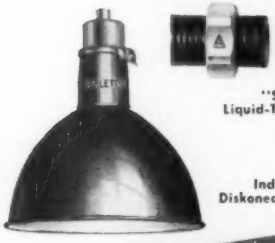
Malleable Iron Unilet Fittings Form 35

Outlet Boxes

Switch Boxes and Covers



Malleable Iron Unilets—FS and FD Series



"ST" Series Liquid-Tight Connectors

Industrial Diskonect Reflectors

General Offices and Plant No. 1, Chicago, Illinois — More than 660,000 Sq. Ft.

Foundry Division, Plant No. 2, South Milwaukee, Wisconsin — More than 140,000 Sq. Ft.

Lighting Division, Plant No. 3, Chicago, Illinois — More than 100,000 Sq. Ft.

Still Growing!

APPLETON

ELECTRIC COMPANY

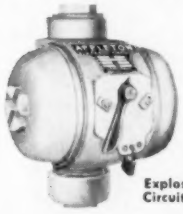
today more than ever
"The Standard for Better Wiring"

More than 900,000 Sq. Ft. of Floor Space!

No company thrives for long unless its products satisfy. We're proud that our steady growth for over 50 years continues unabated . . . and we believe that APPLETON quality and service deserves a large part of the credit. More than 98,000 square feet of floor space were recently added to APPLETON's productive capacity . . . a good sign of future benefits to you in terms of *even better* service and quality products mass-produced to sell at lowest possible prices.

V-51 Series Vapor-Tight Fixtures

AA-51 Series Explosion-Proof Fixtures



Explosion-Proof "CS" Circuit Breaker Unilets

Explosion-Proof "LS" Motor Starter Unilets

Reelite Automatic Extension Reels

Sold Exclusively Through Selected Wholesalers

APPLETON ELECTRIC COMPANY
1704 Wellington Avenue • Chicago 13, Illinois

APPLETON ELECTRIC PRODUCTS — REG. U.S. PAT. OFF.

Rely on **APPLETON** *. . . The Standard for Better Wiring for Over 50 Years*

. . . CALL **WESCO**

8 REASONS WHY BERMICO® FIBRE CONDUIT is your BEST CABLE PROTECTION

1. **WATERPROOF.** Bermico's water absorption factor is extremely low—its insulation factor extremely high, even under toughest conditions.
2. **ACID RESISTANT.** Resistant to soil acids and alkalies, Bermico Conduit is, itself, chemically inert.
3. **SMOOTH INSIDE BORE.** Quick and easy cable "pull throughs"—without danger of abrasions—when you're using Bermico *inspected* conduit!
4. **UNIFORM.** Four rigid factory inspections guarantee Bermico's uniformity of dimensions, specifications and quality.
5. **NO SPLIT COUPLINGS.** With Bermico's specially designed couplings, you end the expense—the loss of time required to replace broken couplings.
6. **STRONG.** Bermico Conduit is engineered to take the shocks and stresses of transport . . . the heavy loads imposed during installation.
7. **TIGHT.** All joints are precision milled for light, speedy, installations.
8. **EASILY HANDLED.** So light in weight that one man can carry several 8-foot lengths at once—lay more per working hour.

Production facilities and schedules are geared to assure prompt shipments

Distributed by

WESTINGHOUSE ELECTRIC SUPPLY COMPANY

Offices in all leading cities

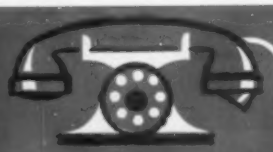
QUALITY

For best cable protection, be sure to specify

BERMICO FIBRE CONDUIT — A PRODUCT OF BROWN COMPANY

Mills—Berlin, N. H.

For Competitive Prices—Call WESCO—for Quality Electrical Supplies and Service



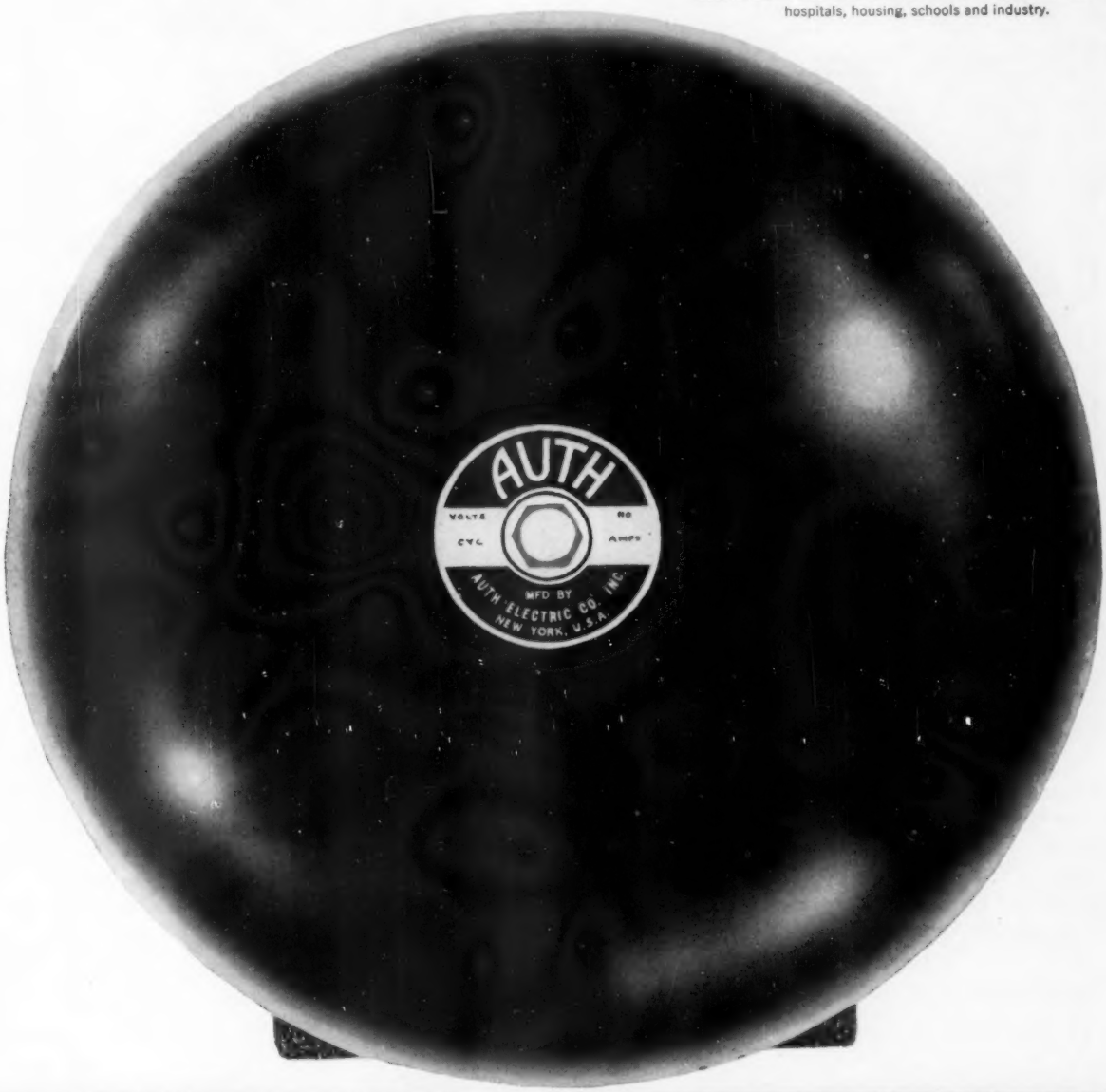
FOR EVERYTHING ELECTRICAL.

Wanna buy a bell?

When you do, come to Auth . . . and buy buzzers, chimes, horns and sirens too. A complete variety is available, from midget buzzers that whisper "Come in, Miss Smith", to giant gongs that clang "FIRE! Get out!". They're easy to install and provide rugged, trouble-free operation with a minimum of maintenance. Get your copy of handy Audible Signals Catalog No. 105 by writing to: *Auth Electric Company, Inc., Long Island City 1, N. Y.*

Auth
SINCE 1892

Manufacturers of audible signals, push buttons, annunciators, transformers, telephones, mail boxes, and complete signaling systems for hospitals, housing, schools and industry.



CALL **WESCO**

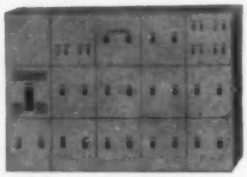
LIFE-LINE "A" MOTORS

LIFE-LINE STARTERS

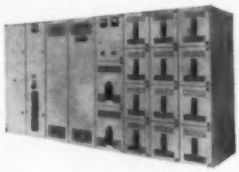
AB-I CIRCUIT BREAKERS

PANELBOARDS

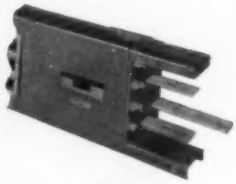
CAPACITORS



BUILDING-TYPE SWITCHBOARDS



POWER CENTERS



BUS DUCT

CONTROL CENTERS

INDUSTRIAL LIGHTING

DRY-TYPE TRANSFORMERS

A complete line of products from a single source

It means this: Your nearby Westinghouse Distributor is a one-call, one-stop source for your electrical apparatus requirements.

He offers complete product lines—Westinghouse Apparatus that's engineered for simplicity and features standardized design to speed your installation work.

He has full product stocks readily available from centralized warehousing facilities. This pinpoints responsibility. It assures quick delivery and helps you make your installations in minimum time.

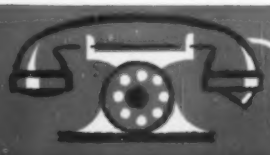
And through your Westinghouse Distributor you get all the engineering, product and application assistance you want. Teams of Westinghouse specialists bring these to you . . . help analyze the electrical problem . . . select, coordinate and apply equipment.

Get in touch with your Westinghouse Distributor for complete information. He is as near as your telephone.

DP-5004-H

YOU CAN BE SURE...IF IT'S

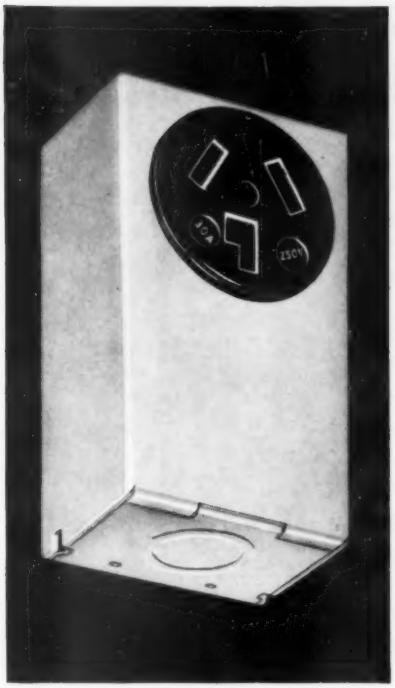
Westinghouse



FOR EVERYTHING ELECTRICAL . .

NEW!

BRYANT 3-WIRE, 30 AMP. POWER OUTLETS

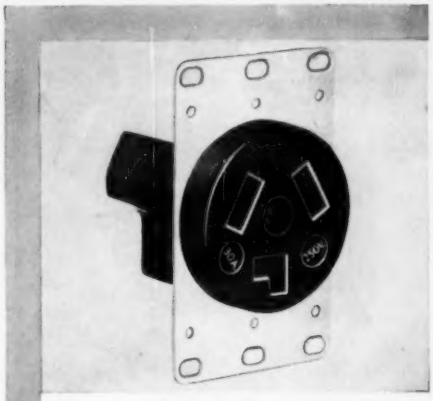


These new outlets have clamp type pressure terminals for faster, more secure connections. They are especially recommended for *electric dryer* installations.

NO. 9304 SURFACE MOUNTING OUTLET

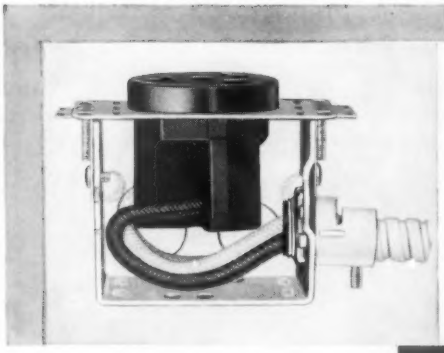
No. 9304 in attractive aluminum enclosure, blends with metal kitchen and laundry equipment. Heavy gage aluminum makes a near-indestructible device. Stainless steel plates available in one and two gangs —each with single opening.

Nos. 9339 and 9339-B all-rubber cord sets have non-removable rubber caps and strain relief cable clamps.



NO. 9303 FLUSH MOUNTING OUTLET

No. 9303 is the only device of its type that can be mounted in a single gang box. It can also be mounted in 4 or 4-1/16 inch square boxes with plaster cover raised ½ inch or more.



HOW TO MOUNT NO. 9303 IN SINGLE GANG BOX

1. Box connector for armored or non-metallic cable *must* be used.
2. Conductors (about 5-5½ inches long) should be stripped ½ inch — use handy strip gage.
3. Insert stripped wire ends under terminal plates — tighten screws.
4. Position in box, as shown at left.

Listed by Underwriters' Laboratories, Inc.

Specify Bryant from your Electrical Distributor

BRYANT
SUPERIOR WIRING DEVICES

J-99908A

THE BRYANT ELECTRIC COMPANY

Bridgeport 2, Connecticut

Chicago • Los Angeles

CALL WESCO

3000 MCM CABLE

AND EVERY HYLUG SIZE BETWEEN

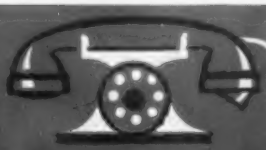
#22 WIRE

WITH TOOLS AND DIES FOR ANY SIZE

BURNDY

54-18

NORWALK, CONNECT. – TORONTO, CANADA • *Factories:* NEW YORK, CALIF., TORONTO • *Export:* PHILIPS EXPORT COMPANY



FOR EVERYTHING ELECTRICAL . .

Four Steps That Mean

Easier, Quicker, Safer Installation of

CRESCENT

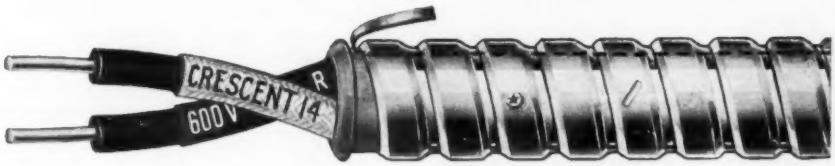
A B C ARMORED CABLE

1 FILE OR SAW GUIDED BY CUTMARK

2 BREAK ARMOR

3 PULL OUT PAPER

4 INSERT INSULATING BUSHING



★ **NOTE CUTMARK** on the fourth turn from right on armor of cable above. This cutmark (at 1½" intervals) shows the location of a prefabricated breaking line inside the armor. Only a few strokes of a file or saw guided by the cutmark are required to cut through one outer ridge, and a bend by hand severs the armor. This results in a clean separation with no sharp edge—a safer, easier and faster job. The prefabricated breaking lines are so designed that there is *no reduction* in tensile strength, bending quality, crushing resistance and electrical conductivity of armor.

★ **NOTE BOND WIRE UNDER ARMOR** which is in contact with the under side of each convolution. This provides permanently low armor resistance. It is furnished in sizes No. 14 and 12 AWG Cable.

★ **GENUINE A B C CONSTRUCTION** provides for easy insertion of the insulating bushing because the paper under the armor readily *unwraps from under both ends* providing space to insert the bushing.

★ **All GLASS BRAIDS** protect the rubber insulated conductors, and are flame, moisture and rot proof. The use of ALL GLASS braid results in a cable with smaller diameter and lighter weight, being easier to handle and install.

CRESCENT
WIRE & CABLE

OVER 70 YEARS EXPERIENCE

CRESCENT INSULATED WIRE & CABLE CO.

TRENTON, N. J.

Proven On loads *UNDER* 600 Amps....

Fusetron dual-element Fuses Have an Interrupting Rating in Excess of 100,000 Amps.

An interrupting rating in excess of 100,000 amperes for FUSETRON dual-element fuses . . . this was shown by tests that were conducted under conditions that simulated the most severe field conditions. These tests were witnessed and verified by the Electrical Testing Laboratories of New York.

The test circuits were set to deliver far in excess of 100,000 amperes — yet the 250 and 600 volt FUSETRON fuses cleared the shorts without igniting readily flamable material placed around the fuses . . . and there was comparatively little noise.

These tests show that Fusetron fuses, even in the small 30 ampere range, can interrupt safely the most severe available short circuit current.

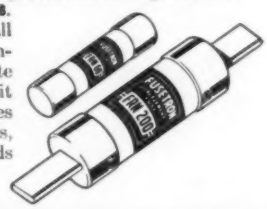
No interference with time-lag

Time-lag is of utmost importance to give proper motor and electrical protection and to eliminate needless blowing of fuses. Even though the interrupting capacity has been greatly increased, the time-current characteristic of Fusetron fuses has in no way been disturbed.

ALL THIS ADDED SAFETY

without changing a panelboard or switch . . . plus 10 point Protection of FUSETRON dual-element FUSES!

1. Protect against short-circuits. **2.** Protect against needless blows caused by harmless overloads. **3.** Protect against needless blows caused by excessive heating — lesser resistance results in much cooler operation. **4.** Provide thermal protection — for panels and switches against damage from heating due to poor contact. **5.** Protect motors against burnout from overloading. **6.** Protect motors against burnout due to single phasing. **7.** Give double burnout protection to large motors — without extra cost. **8.** Make protection of small motors simple and inexpensive. **9.** Protect against waste of space and money — permit use of proper size switches and panels. **10.** Protect coils, transformers and solenoids against burnout.



Fusetron Fuses Help eliminate needless Shutdowns for Production Engineers.

Work stoppages caused by needless blows are prevented. Even if all the motors on a circuit start at one time or other harmless overloads occur, the fuse link holds to prevent a shutdown.

Likewise, Fusetron fuses guard against needless blows caused by excessive-heating in panelboards and switches—lesser resistance results in cooler operation.

Fusetron Fuses Offer Maximum Safety for Electrical and Safety Engineers.

With an interrupting rating of 100,000 amperes, Fusetron fuses give the greatest possible protection against damage due to short-circuits. And just as important, they reduce the hazard of motor burnouts due to single phasing and overloading.

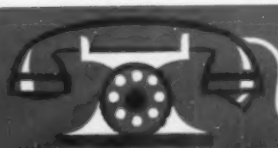
Fusetron Fuses Save Time and Work for Maintenance Engineers.

Once properly installed, Fusetron fuses require no costly inspection time or down-time for calibration and other maintenance necessary on mechanically operated devices.

Unnecessary repair work on motors is avoided because Fusetron fuses reduce to a minimum the danger of damage due to electrical faults. If trouble occurs, instead of rewinding or replacing burned out motors, simply replace Fusetron fuses.

Switches and panelboards are protected against damage from poor contact heating.

Fusetron fuses also protect against needless blows that cause irritating interruptions of regular maintenance.



FOR EVERYTHING ELECTRICAL . .

Proven On loads *ABOVE* 600 and up to 5,000 Amps.

BUSS Hi-Cap Fuses Have an Interrupting Rating In Excess of 100,000 Amps. . . *and their blowing time can be coordinated with that of Fusetron fuses.*

An unlimited interrupting rating for BUSS Hi-Cap fuses on any voltage up to 600 . . . this was confirmed by tests reported by the Electrical Testing Laboratories of New York.

BUSS Hi-Cap fuses are designed to give protection against dangerous overloads as well as high fault currents — yet retain the speed of operation necessary to limit heavy short currents to safe values.

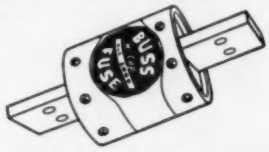
When coordinated properly with Fusetron dual-element fuses they will not open ahead of the fuse nearest to the fault — thus the trouble is isolated to the part of the circuit in which the fault occurs.

Added SAFETY on Old Installations

On installations where the increase in the capacity of the circuit has outgrown the interrupting rating of the circuit breakers, BUSS Hi-Cap fuses offer a safe and relatively inexpensive way to protect inadequate breakers against rupture in event of bad fault.

ACTION THAT SAVES YOU MONEY

Don't risk losses. Delay may cost you far more than replacing every fuse with a FUSETRON fuse. By passing the word along that all purchase and stock records should call for FUSETRON dual-element fuses on loads up to 600 amperes — and BUSS Hi-Cap fuses on loads above that, you get action that begets money saving.



On New Construction tell your architect to specify this Safer, Better Protection.

Fusetron Fuses Cuts Cost for Top Management.

Cuts maintenance cost — Fusetron fuses are maintenance free.

Cuts motor repair cost — Fusetron fuses guard the motor, against damage due to overloading, single phasing, short circuits and other electrical faults.

Cuts production costs — Shutdowns due to needless blows are eliminated.

Cuts new installation costs — Smaller sizes can be used, therefore big savings can be made on switches and panelboards.

Cuts present installation costs — Fusetron fuses hold and won't open on starting currents so the need for larger panelboards and switches is often eliminated — and in many cases new motors can be added to the circuit without installing larger panelboards or switches.

Play Safe—Install Fusetron Fuses and BUSS Hi-Cap Fuses now!

For blowing time charts or more information on FUSETRON fuses and BUSS Hi-Cap fuses use coupon or write for bulletin FIS and HCS.

FUSETRON
TRUSTWORTHY NAMES IN ELECTRICAL PROTECTION
BUSS

BUSSMANN Mfg. Co.
(Division of McGraw Electric Co.)
University at Jefferson, St. Louis 7, Mo.
Please send me complete facts about FUSETRON dual-element Fuses and BUSS Hi-Cap Fuses.

*Name*_____
*Title*_____
*Company*_____
*Address*_____
*City & Zone*_____ *State*_____ ECM-11-54

"From the meter to the load, coordinated Westinghouse products save installation time and operating expense."

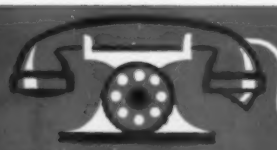
By applying Inerteen® Capacitors, power bills dropped nearly $4000

Many plants—like this Midwestern concern—are amazed at how much improved power factor can lower operating costs.

The capacitor bank, here, is one of eight installed. They total 720 kvar and have raised power factor from 69 to 95%. Result: Motor performance improved through better voltage regulation. Power bills have been cut by an average of $315 a month—an annual savings of $3780.

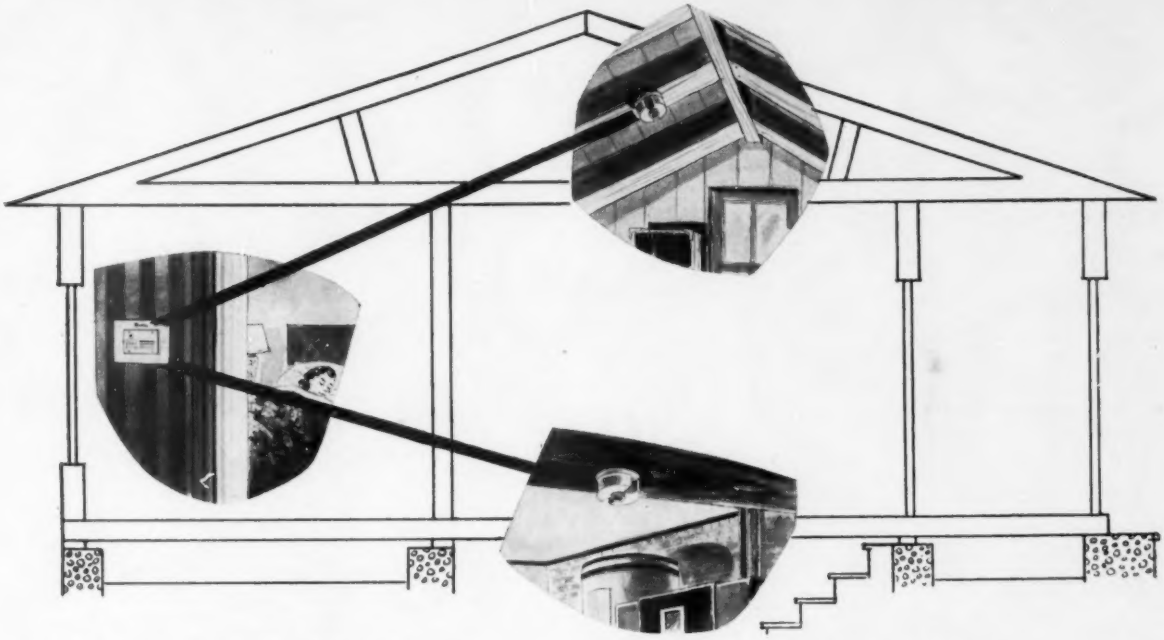
Westinghouse Inerteen Capacitors will bring similar savings wherever inductive equipment is used. They do it by applying nonproductive current direct to the load. This permits more of a system's capacity to carry useful working current. DP-5001-D

YOU CAN BE SURE...IF IT'S Westinghouse



FOR EVERYTHING ELECTRICAL . .

Terrific new chance for extra profits...



EVERYBODY'S a prospect for the NEW EDWARDS HOME FIRE ALARM!

Here's one product everybody you deal with should have — the new Edwards home fire warning system. Why? Because it offers something everybody wants and needs — *permanent fire protection.* Remember — over 300,000 homes had fires last year. 5,000 people died from home fires — over a thousand, children under five years old. Point out these facts to your prospects. Tell them that in most fires it's the first five minutes that count — that the Edwards Home Fire Alarm can save a life, a home.

Show your customers how the Home Fire Alarm works. Just hold a match under one of the two detectors on the display . . . hear the loud clear alarm sound off. Show them how they can test the system any time by just pressing the test button. Explain that you install the detectors in furnace area and attic. That they sound the alarm when the temperature rises above 140°F. . . . UL approval means they are sure to work. Show your customers how the system uses low cost, quickly installed bell wire . . . that it's fool proof, automatic, never needs servicing or adjusting.

Here is the hottest new salesgetter in the residential field. Cash in . . . now!

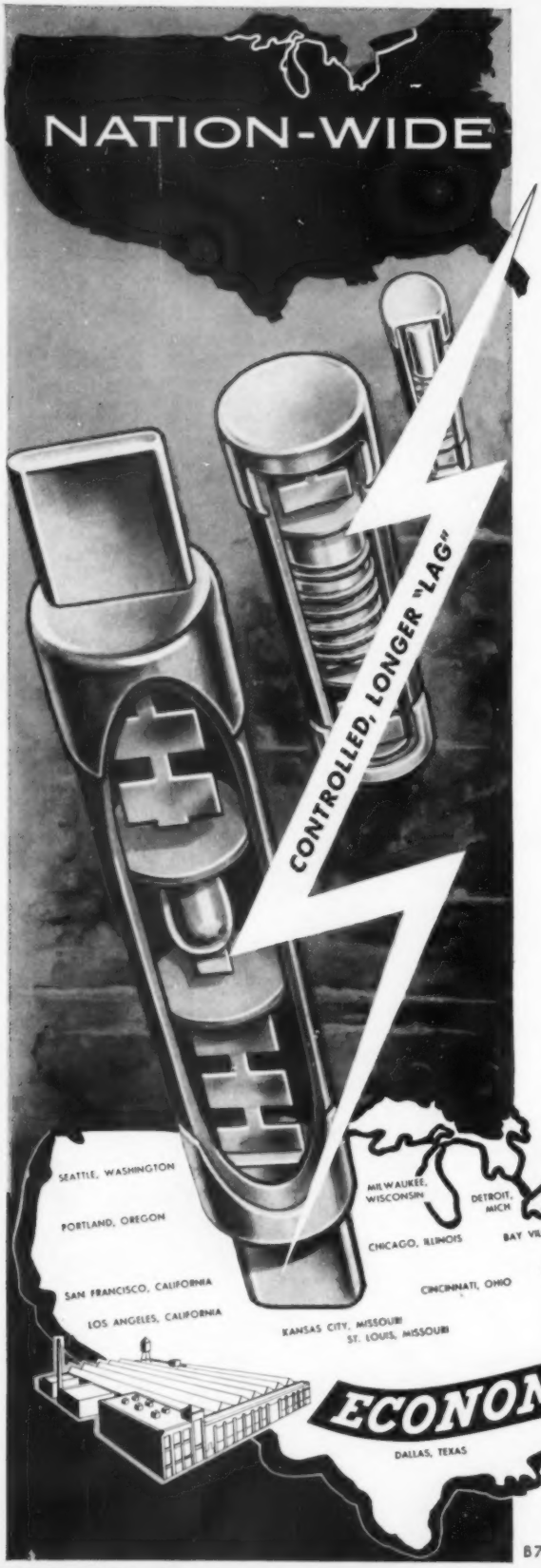
COMPLETE PACKAGE ONLY $19.95 LIST

FREE! Ad mats, catalog pages, envelope stuffers! Write Edwards Company, Dpt. ECM-11

EDWARDS NORWALK, CONNECTICUT

IN CANADA, OWEN SOUND, ONT.

CALL WESCO



PROTECTION

Against Overloads & "Shorts"

ECON®

DUAL-ELEMENT cartridge fuses

From Massachusetts on the Atlantic to Washington on the Pacific, and from Canada to the Gulf Coast, industry is now enjoying the advantages of more dependable protection for electrical equipment and circuits . . . thanks to ECON Dual-Element Cartridge Fuses.

Eighteen strategically located district offices assure electrical wholesalers and fuse users of Economy's readiness to solve circuit protection problems.

ECON Dual-Element Fuses, in addition to providing dependable motor and branch line protection, also act as an effective guard against high temperatures and their resulting hazards. Available in knife and ferrule types, 0 to 600 amperes, 250 and 600 volts. Underwriters' Laboratories, Inc. approved. Carried in stock by leading Electrical Wholesalers. Write for New Econ Catalog S-60 or for literature on other type fuses in which you are interested.

Your Electrical Wholesaler has ECON Dual-Element Cartridge Fuses in stock

ECONOMY fuses for every purpose

ECONOMY FUSE & MANUFACTURING CO.

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FOR EVERYTHING ELECTRICAL

G&W

unit package

Splicing Kits

When You Order Cable Splicing Materials Separately You *Waste Time, and Money* Going Through All the Following Steps—

- Design the joint. Figure the bill of material.
- Issue requisitions to purchasing department.
- Find sources of supply for each item.
- Get quotation and delivery promise on each item.
- Place order for each item.
- Receive materials and assemble.
- Issue materials to cable splicers.

When You Order Cable Splicing Materials in Unit Package Kits You *Save Time and Money* Because—

- Time and expense of securing various items from different sources is saved.
- No lengthy material specifications are necessary.
- Both design and installation methods can be standardized.
- All joints are properly designed to industry standards by expert engineers.
- Each item is supplied in the correct quantity for a properly designed joint.
- Accumulation of dead stock is avoided. No waste.
- All materials are kept clean and ready for use.
- Each Unit Splicing Kit is labeled for easy identification.
- Easy to quickly estimate costs for any particular job.

For your convenience, we carry in stock all the materials required to make joints on any size cable and we regularly supply these materials in unit package form.

G&W Splicing Kits include each necessary item of material in the correct grade and proper quantity for making a cable joint of our standard design (or your own design or special type).

G&W Splicing Kit Bulletins are Yours on Request.

BUL. CJ1—*Straight 2 way*—VARNISHED CAMBRIC, LEAD COVERED. Single and Multiple Conductor BELTED.

BUL. CJ2—*Straight 2 way*—VARNISHED CAMBRIC, LEAD COVERED. Three Conductor SHIELDED.

BUL. CJ3—*Straight 2 way*—PAPER INSULATED, LEAD COVERED. Single and Three Conductor BELTED.

BUL. CJ4—*Straight 2 way*—PAPER INSULATED, LEAD COVERED. Three Conductor SHIELDED.

BUL. CJ5—*Straight 2 way*—RUBBER INSULATED, LEAD COVERED. Single and Multiple Conductor.

BUL. CJ6R—*2 way & 3 way Y*—RUBBER INSULATED, NEOPRENE JACKETED. Single and Three Conductor.

BUL. CJ7—Cable Terminating Kits for Single and Three Conductor. RUBBER INSULATED, NEOPRENE JACKETED.

BUL. CJT—*2 way & 3 way Y*—TELEPHONE & SIGNAL CABLE JOINTS.

You can order splicing kits without referring to bulletins—

SPECIFY: Quantity; Type—2 way or 3 way Y; Complete cable data *including number, size and type of conductors, kind and thickness of insulation and covering, shielded or nonshielded;* Operating voltage, grounded or ungrounded neutral. When wanted.

G&W ELECTRIC SPECIALTY CO.

7780 Dante Avenue, Chicago 19, Illinois

Representatives in principal cities of U.S.A.
In Canada—Powerlite Devices, Ltd., Toronto, Montreal & Vancouver

J545

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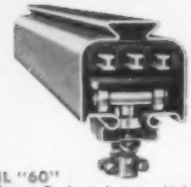
FEEDRAIL® Trolley Busways
Handy Selection Guide



FEEDRAIL "60"

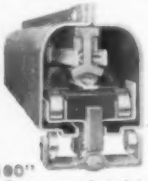
Applications: Budget hoists, light tonnage monorails, small portable tools, lighting, cutting and sewing equipment.

Capacity: Continuous current rating—60 amperes; 250 volts A.C. or D.C.; 2 or 3 pole.

Track: Plain, curved, door, sectionalizing and transfer sections.

Trolleys: 15 Amperes, fusible and non-fusible. New special service 20 ampere fusible and non-fusible trolleys for use with budget hoists and monorails. 8 ampere plug-in jacks for stationary service.

Additional data in Bulletin No. 45.



FEEDRAIL "100"

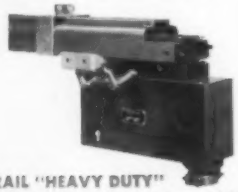
Applications: Cranes and hoists, portable tools, production and test lines, machine tools, airport hangar doors.

Capacity: Continuous current rating — 100 amperes; 575 volts A.C. or 250 volts D.C.; 2 or 3 pole.

Track: Plain, curved, door, sectionalizing and transfer sections.

Trolleys: 20 and 30 ampere fusible and non-fusible types, with and without receptacles, to meet a wide range of requirements. Non-fusible crane and hoist trolleys in 30, 60 and 100 ampere capacities.

Additional data in Bulletin No. 40.



FEEDRAIL "HEAVY DUTY"

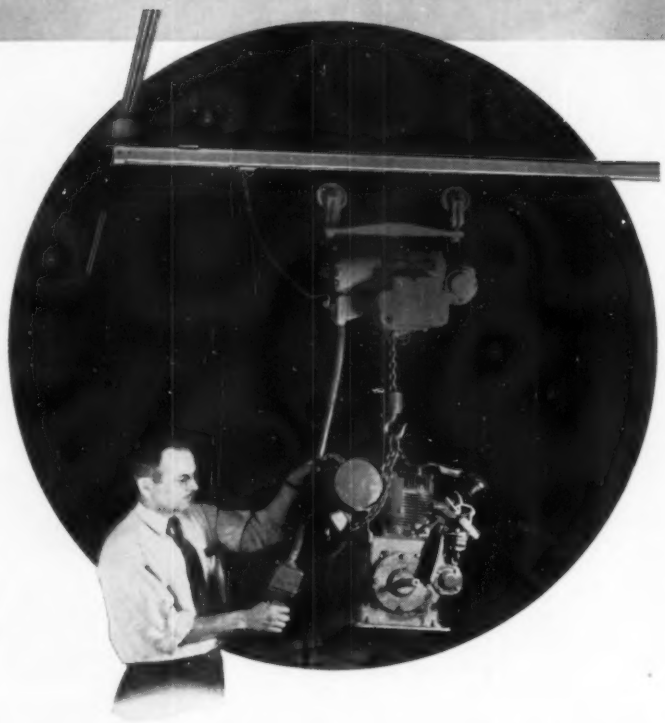
Applications: Heavy duty cranes and hoists, large machine tools, conveyor assembly lines.

Capacity: Continuous current rating — 225, 375 and 500 amperes; 575 volts A.C. or 250 volts D.C.; 2 or 3 pole.

Track: Plain, door and expansion sections.

Trolleys: 225 amperes with bottom or side outlet.

Additional data in Bulletin No. 35.



Feedrail is the safe, dependable way to distribute electrical power to moving or stationary equipment.

The modern Feedrail Trolley Busways eliminate the problems and troubles of open wiring, accidental contact, and long trailing cables. All current-carrying components are protected by sturdy steel housings. Easy rolling trolley outlets, supported by the protective track housing, take off power from the bus bars at any point along the length of a run. There's no chance of broken conductors suddenly interrupting operation. The entire installation is compact, out of the way and trouble-free.

Track, trolleys and accessories are soundly engineered and built to high precision standards that mean long life. Its design includes every provision for fast, easy installation — maximum safety and dependability.

FOR FULL DETAILS write for descriptive literature. We can help you better if you state your requirements. Address Dept. C-11.

SPECIALLY QUALIFIED REPRESENTATIVES IN PRINCIPAL CITIES

G4-1

ELECTRIC FEEDRAIL®

Never Becomes Obsolete

FEEDRAIL CORPORATION

Subsidiary of Russell & Stoll Company, Inc.

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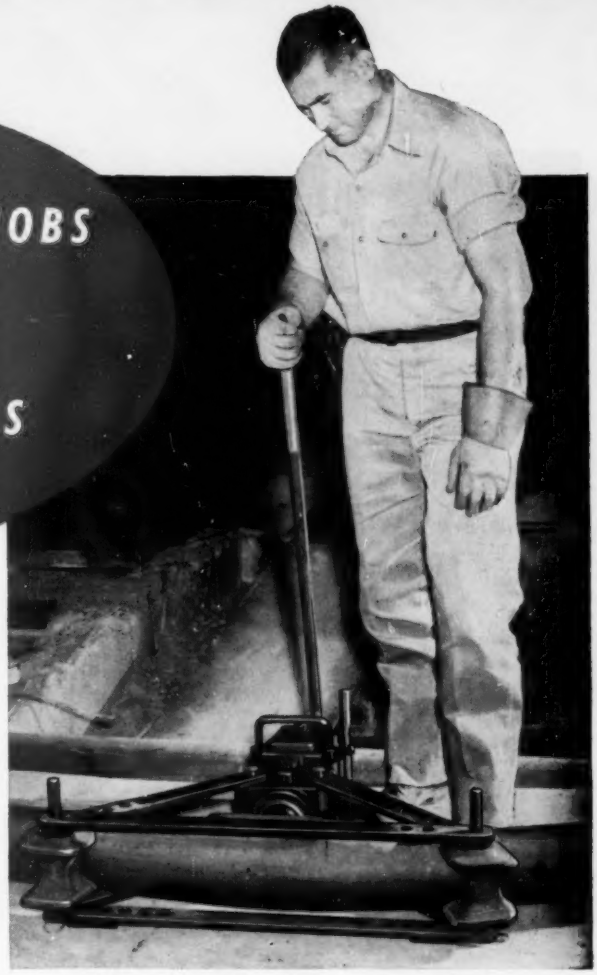
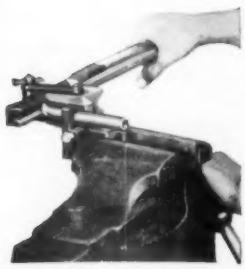
FOR EVERYTHING ELECTRICAL.

CUT COSTS...SPEED JOBS WITH GREENLEE TIMESAVING TOOLS



Greenlee Hydraulic Conduit Bender

Conduit installations go far faster . . . neat, tailor-made jobs result every time with a GREENLEE Bender. Many owners report labor savings from 50% to 90% . . . and the cost of many manufactured bends and fittings is eliminated. For, with the GREENLEE, *one man* in but minutes makes smooth, accurate bends in pipe up to 5", rigid and thin-wall conduit, tubing and bus bars. Compact and portable, the GREENLEE Hydraulic Bender can be easily and quickly moved for *on-the-job bending* exactly where and when wanted! *Users say it often pays for itself on the very first job.*



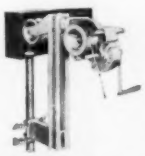
Hand Benders for Tubing

Swiftly produce accurate small-radius bends (up to 180°) in conduit, pipe and tubing. No flattening or kinks. GREENLEE Hand Benders are especially designed to form neat bends to fit sharp corners, nooks and other close quarters. Eliminates need for many manufactured bends and fittings. Various sizes and models . . . handy companion tools to GREENLEE Hydraulic Benders for quickly "custom making" your own complete conduit installations *right on the job.*

Knockout Punches and Hydraulic Punch Driver

Quick, easy way to make knockout enlargements for ½" to 4" conduit. Simply insert GREENLEE Knockout Punch in knockout or small drilled hole, then turn with an ordinary wrench. For an even faster, practically effortless operation, drive Punch with powerful, portable GREENLEE Hydraulic Driver shown below.

Boring Tools For quickly making clean, smooth openings for conduit and wiring. The GREENLEE line includes Electricians' Unispur and Solid-Center Auger Bits, Bell Hangers' Drills, Expansive Bits, and Bit Extensions.



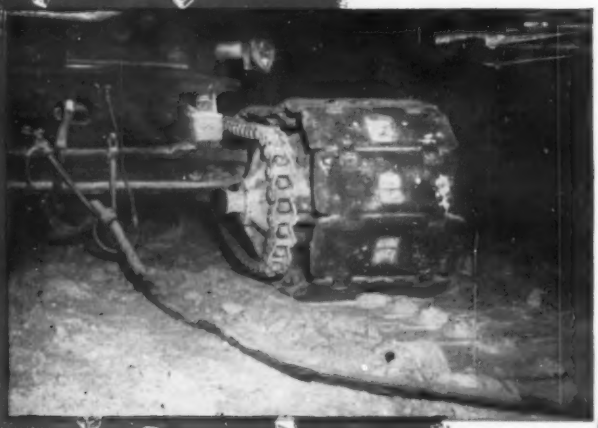
Cable Puller Easy-operating, compact unit for 7,500 pound pull. Fastens directly to conduit for pulling in line with conduit . . . no loosened hangers. Attachment available for concealed conduit work.

SEE YOUR ELECTRICAL DISTRIBUTOR Get complete information on the above and other GREENLEE timesaving tools: Hydraulic Pipe Pushers • Joist Borers • Chisels and Gouges • Radio Chassis Punches • Angle-Screw Drivers • Spiral Screw Drivers • Automatic Push Drills • and many more. Greenlee Tool Co., 1751 Columbia Avenue, Rockford, Illinois.

TOOLS FOR CRAFTSMEN
GREENLEE

CALL WESCO

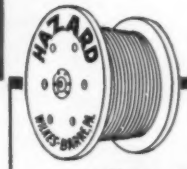
Jefferson Island salt mine standardizes on HAZACORD . . . and saves



The Jefferson Island Salt Mine—where salt analyzes better than 99% pure NaCl—is located 1,000 feet below sea level at Jefferson Island, Louisiana. Operating conditions in the salt beds are so difficult that ordinary cables were chewed up by the abrasive action of the salt. Before standardizing on Hazacord Portable Cables, 25 to 40 man hours per week were spent on repairs to the portable cables used on undercutters, jumbo drills and electric shovels. Now—with Hazacord—this costly repair work is eliminated.

Toughness to resist abrasion, twisting and flexing, such as in this installation, is built into every Hazacord by vulcanizing the Hazaprene ZBF sheath in a continuous metal mold. The Hazaprene sheath resists such destructive agents as acids, alkalies, moisture, and most oils and greases. Hazard heat-resisting insulation assures long electrical life because of its high safety factor under all operating conditions.

Consult your Hazard representative for recommendations on the Hazard cable applicable to your operating conditions or write Hazard Insulated Wire Works, Division of The Okonite Company, Passaic, N. J.



HAZACORD

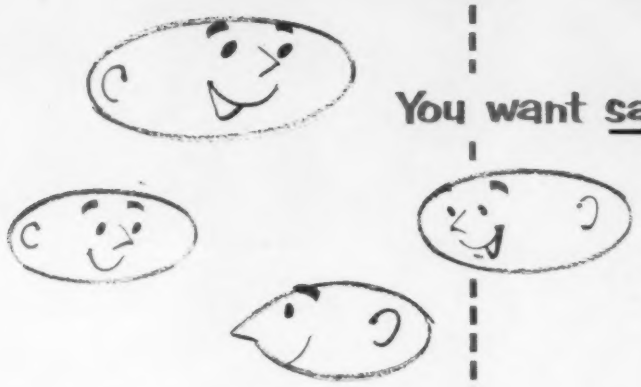
Molt-Cured

portable cables

PRODUCT OF OKONITE RESEARCH

2133

FOR EVERYTHING ELECTRICAL

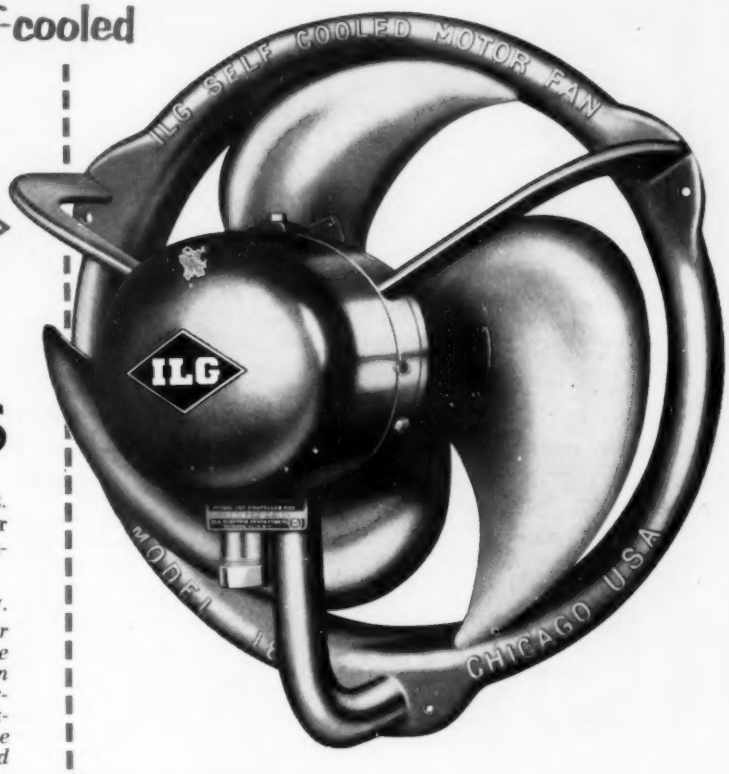


You want satisfied customers!

You get them with self-cooled

ILG

PROPELLER FANS



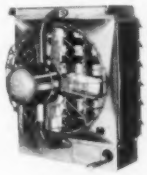
Install and forget . . . that's all there is to it. Here's the one fan that is precision built for trouble-free performance . . . and complete customer satisfaction.

Check these 7 reasons why . . . before you buy.

- *ILG's exclusive Self-Cooled Motor never "gums-up" because whenever the fan is operating, cool, clean air is drawn in from the outside. This cool air is circulated through the motor, then exhausted at the front of the motor. The motor stays clean, cools itself . . . and lasts longer.*
- *Rugged cast frame keeps working parts aligned for decades.*
- *No belts to stretch, wear out, need replacing.*
- *No pulleys to waste power, get out of alignment.*
- *Double-sealed, permanently lubricated, ball bearing motor.*
- *Patented ILG fan blades deliver more air quietly, with greater efficiency.*
- *"One-Name-Plate" Guarantee covers both motor and fan as a single unit.*

Customer satisfaction? You can always be sure when it's ILG ventilating equipment. Quality known and trusted the world over—since 1906.

ILG ELECTRIC VENTILATING CO.
2850 N. Pulaski Road, Chicago 41, Illinois

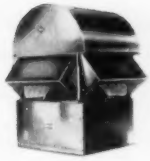


ILG
Unit Heaters

The complete line—steam, hot water, gas or electric—with capacities ranging from 18,600 BTU to 286,000 BTU.

ILG
Centrifugal Fans

Designed for a wide variety of pressure and volume requirements—certified capacities ranging from 374 to 116,400 CFM.



ILG
Power Roof Ventilators

Long-lasting, quiet, easy to install, leakproof—provide efficient ventilation independent of wind and weather.

CALL WESCO

IDEAL Offers a Complete Line of WIRING TOOLS YOU NEED

. . . to Make Any Wiring Job Easier!
. . . to Cut Your Wiring Costs!

IDEAL FISH TAPE, REEL and PULLER

(Patented, No. 1,890,945)

Saves Time and Work —Protects Tape

A three - in - one tool that saves up to 50% in fishing time. Reel gives BIG pulling power that makes long conduit runs easy to handle. SAFER because tape is always under control in the reel or conduit—can't spring loose or kink. Reel protects the hands and eliminates need for special pullers, pliers or bare-hand pulling. Tape is finest flat, tempered spring steel. Five stock sizes and lengths, 50 to 200 feet.

EVERYTHING YOU NEED FOR FISHING

IDEAL furnishes a complete line of fish tapes and accessories, including: flat fish tape, with or without reel; round and nylon covered tape, with or without reel; Coil-Flex (spring type) tape, fish tape leaders and fish tape balls.

The Super-Safe IDEAL VOLTAGE TESTER

You Can't Buy a Safer Voltage Tester— To Save Your Life!

Provides *double protection* —a calibrated solenoid indicator *and* a neon test lamp, each independent of the other. *There is no chance of failure to detect voltage.* Handy center mount for test prod keeps indicator always in line of vision. Fully enclosed case is of double strength, seamless plastic, with plastic name plate bonded to case—*no surface metal.* Moisture - tight, molded - rubber prod handles with "No-Slip" safety rings are mounted on 30" neoprene leads. Prod storage in case completely shields sharp tips when prods are not in use. Tests 110 to 550 volts AC —110 to 600 volts DC.

IDEAL "E-Z" STRIPPER

Rugged, All-Steel Construction for Fast, Clean, Heavy-Duty Stripping

As easy to use as pliers. Does not score or damage wire. At end of stripping stroke, automatic lock prevents snap-back and crushing of stranded wire. Replaceable blades are of hardened steel. Eight models handle all wire gauges from No. 8 to No. 26; also 300 ohm TV down-lead and most non-metallic sheathed cable.

IDEAL Stripmaster

(Patented, No. 2,523,926)

Exclusive "One - Squeeze" action strips wire clean in 2 seconds! Especially suited to lighter stripping.

IDEAL WIRE LUBE

Makes Wire Pulling Easier and Quicker . . . Protects Insulation

Applied by hand or brush. Provides a thin film of lubricant that makes tough wire pulling jobs far less work. Dries quickly to a fine powder that makes it easier to remove wire from conduit later if necessary, or to add additional wires. Non-corrosive, non-combustible — harmless to hands. For use on rubber, lead or plastic covered wire cable. (Cannot be used on asbestos covered wire.) In 1-qt. to 5-gal. cans.

IDEAL DELUXE CABLE RIPPER

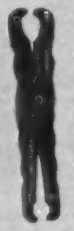
Rips Outer Sheath From Non-Metallic Cable Instantly

Faster because cable is inserted into cradle of the tool from side. No time lost in threading it into cutters, etc. Depth of cutting blade is adjustable for different sizes of cable. Blade is replaceable. Handles cable up to ½" O.D. Built to last for years.

Cable Ripper and Wire Gauge

Cuts cable cleanly and easily. Just squeeze onto cable and pull. For non - metallic, sheathed or lead covered cables with O.D. up to ⅝". Very inexpensive.

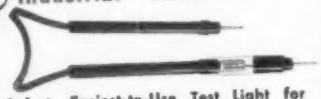
IDEAL "SAFE-T-GRIP" FUSE PULLER



Assures Safe, Positive Grip

Do away with the danger of pulling and replacing cartridge fuses by hand and the bending of clips through improper removal. *Formed to fit the fingers—no slipping.* Strong, laminated fibre construction. High dielectric properties. Three sizes for practically all fuses.

IDEAL Industrial "TEST-GLO"



The Safest, Easiest-to-Use Test Light for Electrical Circuits, Sparkplugs, Motors, Fuses, etc.

Resistors between test-prod and lead reduce voltage reaching leads. Long, thin handles for deep probing have safety rings to prevent accidental contact with prods. Enclosed neon test lamp is at front end of prod handle, in line of vision. Glows on 80 to 600 V. AC or DC. Leads are 24" long.

IDEAL CONTINUITY TESTER

Penlite Battery Powered— Tests Dead Circuits without Need for Live Wire Connections

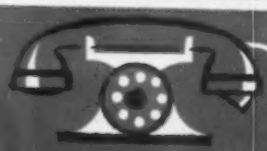
Enables safer testing of unknown or untested circuits in building and household wiring, communication equipment, control panels, etc. To test for electrical continuity between two points just apply the 4-ft. clip to one point in the circuit and touch the prod-clip to the other. Test lead is detachable.

IDEAL ELECTRICIANS TAPES

A Complete Line of Top Quality Tapes— Friction, Rubber and Plastic

You need ALL THREE to meet ALL insulating needs! In popular sizes, conveniently packaged. Friction tape also in special widths and lengths on special order to large users.

IDEAL INDUSTRIES, Inc. 1041 Park Avenue, Sycamore, Illinois



FOR EVERYTHING ELECTRICAL.

INTER-MATIC TIME SWITCHES

a model for every timing need

● For Standard ON-OFF Operations—Series TS60. Single pole, double pole, single throw, double throw, and portable plug-in models . . . 1 to 12 on-off operations a day . . . timings from 1 to 23 hours . . . manual control automatic reset . . . heavy duty . . . rated 35 amperes.

● For Skipping Operation on Selected Days—Series TS66. "Skipper". Skips automatic operation on weekends, holidays or any selected days . . . available in complete line . . . 1 to 11 on-off operations a day . . . timings from 1 to 23 hours . . . rated 35 amperes.

● For ON-OFF Cycles from 5 to 60 minutes—Series T670. Up to 14 on-off cycles a day . . . each cycle independently adjustable from 5 to 60 minutes . . . single pole normally open or normally closed contacts, and single pole, double throw . . . 35 amperes.

● For Automatic Control of Room Air Conditioners — Series P690. Portable, plug-in . . . 1 to 11 operations a day . . . timings from 1 to 23 hours . . . Model P691 has adapter for male plug which permits use on either single phase 2 wire system or single phase 2 wire system with grounding wire. For air conditioners up to 1 horsepower.

● For Poultry House Lighting — Series TS60SP. Single pole, single throw for morning or all night lighting . . . Series TS60PS dimmer switch model for morning and evening or evening only lighting. Also available for portable plug-in use.

FEATURES YOU'LL LIKE

Easy to remove mechanism — just press spring. No screws to drop or misplace.

Easy to set time—just pull dial forward—turn in either direction. New "E-Z See" dial for faster, more accurate setting.

Easy to check operation of the motor thru window in motor cover. Motor is front mounted.

Easy to add extra trippers without removing the dial. Trippers are reset quickly.

Plus many more design features to provide lightning-fast installation and trouble-free operation!

APPLIANCE TIMERS

TIME-ALL. Portable, plug-in time switch . . . turns appliances and lights on and off automatically . . . controls lights, radios, fans, defrosts refrigerators, etc.

TIME-MINDER. Combination electric clock and signal timer . . . timings from 1 minute to 4 hours . . . buzzer sounds at end of time period until shut off manually . . . plaskon case.

CLOCK TIMER. Combination electric clock and appliance timer . . . controls roasters, tape recorders, etc. . . . timings from 15 minutes to 5½ hours . . . cord set and receptacle . . . plaskon case.

***Mf'd by* INTERNATIONAL REGISTER CO., 2624 West Washington Blvd., Chicago 12, Ill.**

Write for Catalog 114-B

CALL **WESCO**

New heavy-duty enclosed switch spells added protection for operators

Complete protection for operating personnel. This is an outstanding feature of the new Westinghouse Type "H" Safety Switch—now ready for rugged, heavy-duty industrial applications.

Available in a complete range (up to 1200 amps and 600 volts), it provides an interlocked cover that cannot be opened when the switch is in the "ON" position. And a Micarta® shield is located over the line terminals. Thus, exposure to the live parts is minimized during inspections or fuse replacement.

Further, this new safety switch offers these "plus" advantages:

1. Neoprene gasket and trunk-type cover latches—resulting in Nema-1A dust-resisting enclosure.
2. Operating mechanism is contained in a rugged cast handle—leaving side gutters free for wiring.
3. Copper parts are tin plated—minimizing corrosion and high resistance oxidation.
4. Westinghouse Exclusive Diamond-pointed Break Jaw and Extended Blade. Arcing occurs outside contact area—keeping parts clean.
5. Westinghouse Exclusive De-ion® Arc Quenchers —extending contact life.

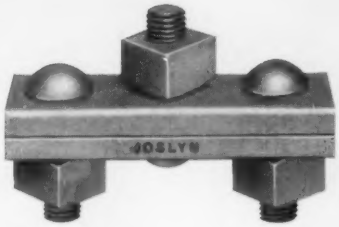
The new Type "H" safety switch is part of a complete Westinghouse line—available for every industrial application.

DP-5004-F

YOU CAN BE SURE...IF IT'S Westinghouse

FOR EVERYTHING ELECTRICAL.

J768 Secondary Rack



J931 Guy Clamp

J1118 Pole Step

COMPLETE

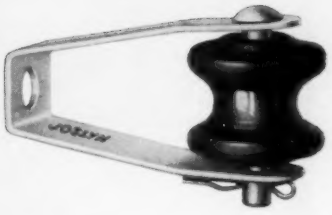
JOSLYN

POLE LINE EQUIPMENT

Is Available at Your Local Westinghouse Electric Supply Company Office

JOSLYN MFG. AND SUPPLY CO.
Executive Home Offices: 20 North Wacker Drive
CHICAGO 6, ILLINOIS

J1092 Eyenut



J0341 Cross Arm Clevis

J6270 Universal Pole Band

J8152 Angle Thimbleye Bolt

5/8" x 12"

J3038 Tubase Guy Clip

CALL **WESCO**

WESCO is a convenient source for Kaiser Aluminum covered and bare conductor in a wide range of sizes and types.

By specifying these conductors instead of equivalent copper you can save as much as 35%!

That's because the initial cost of Kaiser Aluminum conductor is less . . . because lightweight aluminum strings faster and easier to cut installation costs . . . because aluminum reduces strain on house, pole and fittings to minimize maintenance and repair.

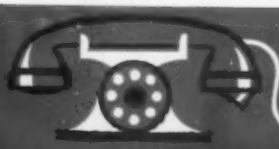
WESCO is a convenient source for Kaiser Aluminum's unsurpassed engineering services—available at no extra cost.

Field engineers work hand in hand with your crews on request; engineering specialists give personal attention to your planning and design; laboratories continually evaluate accessories and check all Kaiser Aluminum conductors against the highest standards of quality.

Next time you contact your nearby Wesco Branch, ask them to give you complete information on Kaiser Aluminum products and services.

The nation's largest producer of triplex and aluminum weather proof wire

Kaiser Aluminum & Chemical Sales, Inc., Oakland 12, California



FOR EVERYTHING ELECTRICAL

Specify EVEREADY BRAND for long life, low operating cost, dependability

"EVEREADY" RR AND INDUSTRIAL DRY CELL No. 6

Specially designed to meet a wide range of service conditions, from very heavy to very light drains.

"EVEREADY" No. 409 LANTERN BATTERY

Gives dependability and long life. Designed to fit many popular types of hand lanterns.

"EVEREADY" "COLUMBIA" "GRAY LABEL" TELEPHONE CELL No. 6

Extraordinarily long life . . . the most widely-used telephone dry cell in the world!

"EVEREADY" No. 1050 INDUSTRIAL FLASHLIGHT BATTERY

Delivers twice the usable white light of any previous "Eveready" flashlight battery. Specially designed for heavy-duty use.

"EVEREADY" No. 950 BATTERY

Gives you the ideal balance of long shelf-life and service-life for all applications, except extreme heavy-duty uses where the "Eveready" No. 1050 battery is recommended.

"EVEREADY" "IGNITOR" DRY CELL No. 6

Outstanding recuperative power makes this battery the finest obtainable for ignition, radio, bells, buzzers, electric games, toys, lanterns, etc.

"EVEREADY" No. 1251 INDUSTRIAL FLASHLIGHT

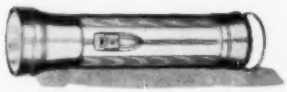
Ruggedly-built case is resistant to shock, water, oils, greases, gasoline, alcohol and acids. Switch is easily removed and replaced by hand. Ring hanger in bottom cap.

"EVEREADY" No. 7251P FLASHLIGHT

Unbreakable, polyethylene lens-guard glows with high-visibility red light for added safety. Cushions shocks, protects head.

"EVEREADY" No. 1259 INDUSTRIAL FLASHLIGHT (APPROVED SAFETY TYPE)

Approved by the U. S. Bureau of Mines and listed by Underwriters Laboratories, Inc. for use in explosive, gaseous atmospheres. Ring hanger and spare bulb in bottom cap.



"EVEREADY" No. 8251 FLASHLIGHT

Automatic spotlight with removable bottom cap and ring hanger. Finished in durable chrome plate.

A simple case of logic

Sherardizing is Galvanizing at its best

SO . . .

Sherarduct

is Galvanized Conduit at its best

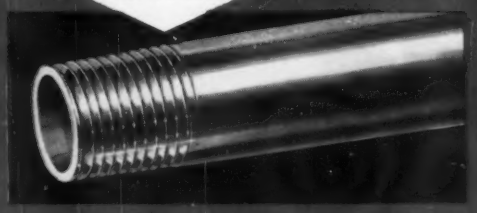
It's the Sherardizing process that fortifies Sherarduct . . . a dry galvanizing process that actually alloys corrosion-resistant zinc to the steel wall. This is galvanizing at its best!

Sherardizing provides 100 percent uniform zinc protection over all surfaces including the hills and valleys of every thread. This is Sherarduct . . . galvanized conduit at its best!

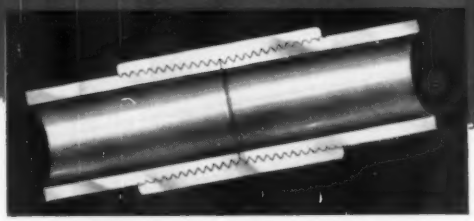
Finally, NE's baked-on Shera-enamel seals the zinc against acids and other corrosive elements. Sherarduct Conduit provides lifetime protection for all wiring.

Insist on National Electric Sherarduct

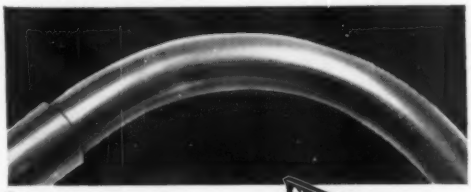
CHECK THESE FEATURES



1. THREADED BEFORE SHERARDIZING so that every clean, sharp thread has uniform full zinc protection.



2. THREAD PROTECTION . . . coupling threads and surfaces are fully zinc protected . . . Sherarduct coupling permits butting of conduit within the coupling.



3. Works easily . . . Fishes easily . . . Bends without flaking.

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National Electric Products

PITTSBURGH, PA.

3 PLANTS • 8 WAREHOUSES • 34 SALES OFFICES

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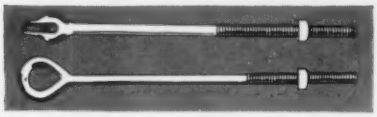
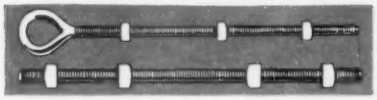
OLIVER...

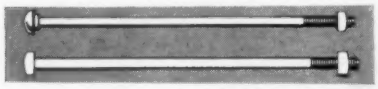
your safest choice in
POLE LINE MATERIALS



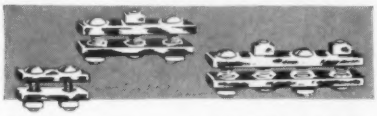
Oliver Bolts have time-saving, waste-eliminating Speed Points for ease in assembly and salvage. "Thimbleye" and Eye Bolts are drop forged for maximum strength.



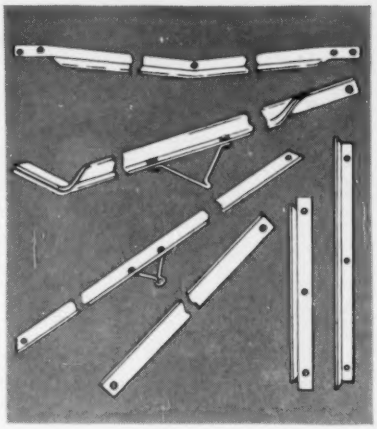
Double Arming Bolts and Double Arming Eye Bolts are threaded full length for maximum adjustment when tying together two crossarms.



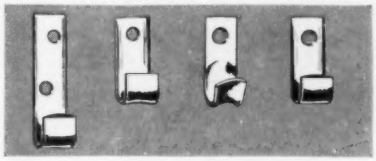
Oliver Carriage and Machine Bolts are made in all standard sizes. Square nuts, rolled thread.



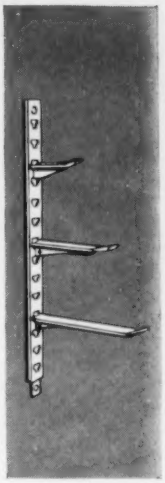
Oliver Guy Clamps are made in light and heavy types with maximum clamping surfaces and generous space for wrench clearance.



Oliver Bracing Materials include vertical, diagonal, alley-arm and crossarm braces.



Oliver Guy Hooks, made from half-oval steel bars, afford maximum protection of guy wire.



Underground Cable Racks are made in sizes to readily provide for a wide variety of lengths and support arrangements. Hooks have well rounded corners and broad bearing surfaces.

You'll find the accuracy, uniformity and clean threads of Oliver Pole Line Materials a real help in speeding line erection. Designed for specific jobs, and held to close tolerances, each piece fits quickly into its place, reducing the time and labor involved in building or extending your service lines.

Oliver Pole Line Materials are formed from new rolled open hearth steel. A heavy coating of prime virgin Western spelter used in hot dipped galvanizing gives added life.

OLIVER IRON AND STEEL CORPORATION

PITTSBURGH, PA.

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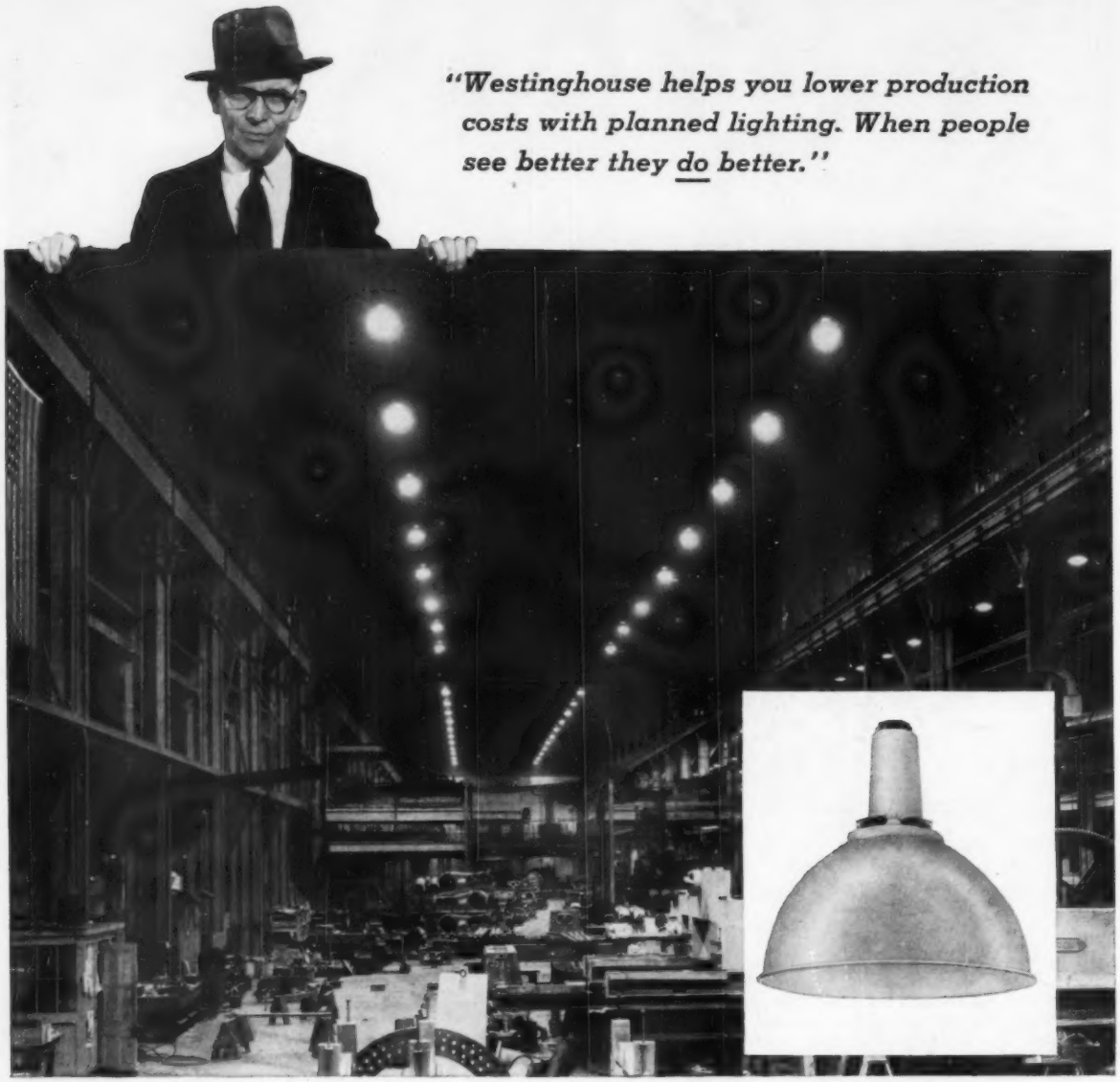

"Westinghouse helps you lower production costs with planned lighting. When people see better they do better."

Ventilated mercury high-bay fixtures cut maintenance...give more light at no extra cost

The modernization need at this Pennsylvania plant: Better lighting with less maintenance. The answer: A Westinghouse Ventilated Mercury High-Bay lighting system.

Mercury sources provided approximately three times more light than the previously used incandescent design—and last seven times longer. At a 48-foot mounting height—the case in this plant—this becomes exceedingly important.

Additionally, the ventilated luminaires help keep reflectors clean . . . yet protect the lamps and provide a controlled lighting distribution system to meet the specific application requirements.

Planned lighting *does* mean economy. The seeing requirement dictates the lighting system and equipment to be used.

Your Westinghouse Distributor stands ready to help you with your lighting problems—whether they involve the shop, office or parking lot. DP-5001-F

YOU CAN BE SURE...IF IT'S

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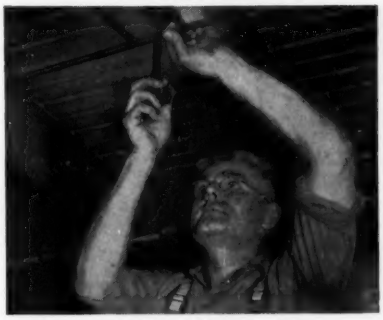
FASTER AND

NEATER JOB!

PLYMOUTH PLASTIC Electrical TAPE

TOUGHER



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NEATER

FOR FINEST OF PLASTIC TAPES

For the neatest job, for the biggest savings in time and money, Plymouth Plastic Electrical Tape is your best buy every time!

MORE PROTECTIVE: Seven solid mils of high dielectric vinyl provide 16% more dielectric and mechanical protection.

MORE PRACTICAL: It saves space and gives more effective protection.

MORE ECONOMICAL: Greater flexibility and stretch make each roll go farther. Does the work of both rubber and friction tape, saving time and money.

Packed individually — one 66-ft. roll, ¾" wide in single pocket size metal can or the convenient 5-pack container with five 30-ft. rolls ¾" wide.

PLYMOUTH RUBBER COMPANY, INC.

Established in 1896

CANTON, MASSACHUSETTS

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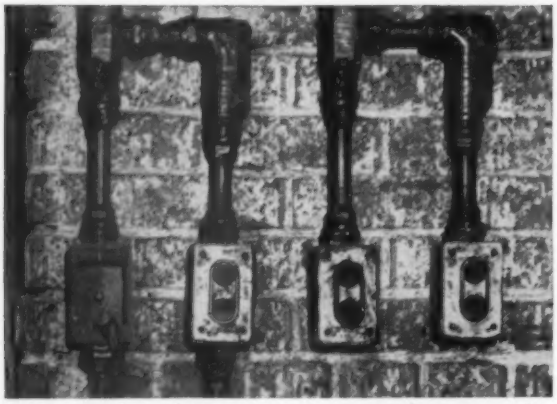
REPUBLIC ELECTRICAL METALLIC TUBING



For protection of electrical raceways, where corrosive conditions are extra tough, Republic "Dekoron", the Plastic Coated E.M.T. is the answer. Moisture-tight joints are easily made using threadless connectors and couplings. Joints are sealed with vinyl or plastic tape. This material also available in Rigid Steel Conduit.

Wherever you are, you can get all these exclusive Republic features just by calling your local electrical distributor.

When you specify Republic E.M.T., you get the "Inch-Marked" feature that lets your electricians make smooth, accurate bends easily. Their work is easier because they have fewer tools to carry around. And the ones they use are light.

Whether it's modernization, connecting machinery in new locations, or installing new electrical raceways, you can do the job easier and faster with Republic products.

"Inside Knurling" in the popular sizes (½", ¾" and 1") of Republic E.M.T. makes wire-pulling up to 30 per cent easier. This is an exclusive feature found only in Republic Electrical Metallic Tubing.

Only Republic Electrical Metallic Tubing is "Inch-Marked®" in the popular sizes. You measure the distance, not the tubing. Cuts easily with a 32-tooth hacksaw blade.

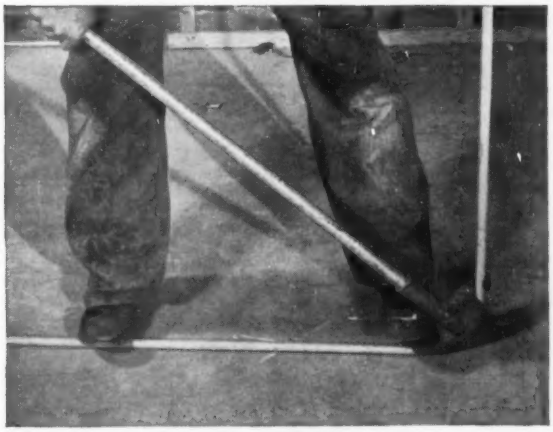
FOR EVERYTHING ELECTRICAL.

FEATURES LOCALLY

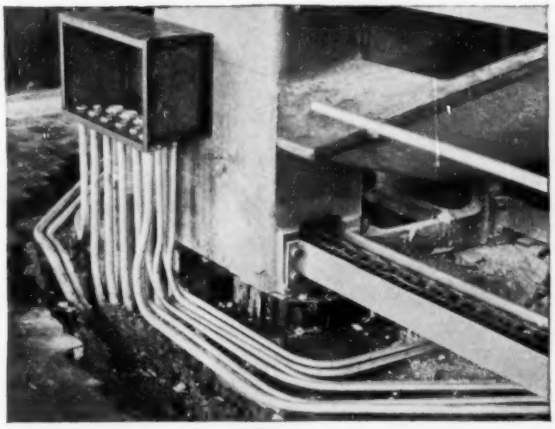
Why not join the contractors who have been saving with Republic E.M.T. for years? On your next job, ask your local electrical supplier for Republic, the "Inch-Marked" E.M.T., and the Republic Calibrated Bender.

REPUBLIC STEEL CORPORATION
Steel and Tubes Division
212 E. 131st Street, Cleveland 8, Ohio
GENERAL OFFICES • CLEVELAND 1, OHIO
Export Department: Chrysler Building, New York 17, N. Y.

Republic E.M.T. in 1¼" size is easy to bend with the Republic Bender. Weighs only 18 pounds, can be carried right to the job by one man. Electrician can use it to make saddles, back-to-back bends and offsets.



Smooth accurate bends and offsets are easy to make, right where they're needed, using the handy reference marks on the Republic Calibrated Bender. Easy-to-follow instructions are included in the Bending System.

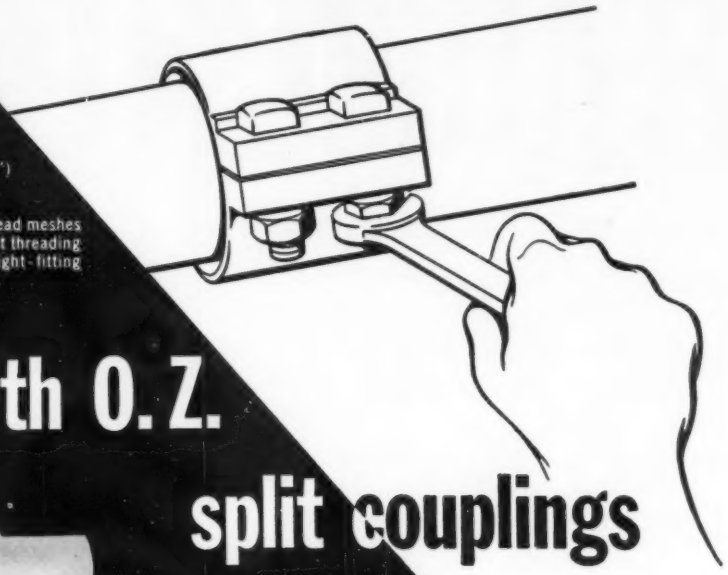


Busy maintenance men like Republic E.M.T. because there are fewer tools to lug around the plant. No threads to cut, because Republic E.M.T. is quickly joined, using Underwriters' Laboratories approved couplings and connectors.

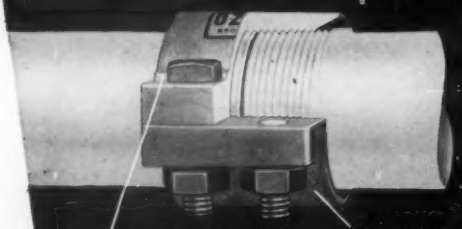
*"TOUGH" conduit coupling jobs

(Type "SP")

Interior thread meshes with conduit threading for rigid, tight-fitting connection.



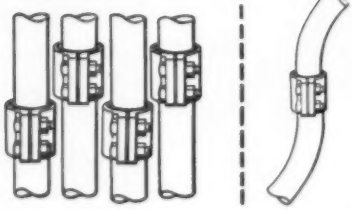
are easy with O. Z. split couplings



Bolt heads are held in place by shoulder on coupling, eliminating need for second tool.

One piece malleable iron construction facilitates handling during installation.

To install, simply slip over one conduit end, butt ends of both conduits, slide fitting back into position and tighten nuts.



* "Tough" – (Where ordinary couplings can't be installed). Are clearances close – near floor, wall, ceiling or other obstructions? Can conduits be turned due to bends? Is space or accessibility a factor? Just install an O. Z. Type "SP" Split Coupling.

Butt the conduit ends within the O. Z. Split Coupling – tighten two nuts with an ordinary open-end wrench and presto . . . you have a permanent, close-fitting, rigid connection.

Drastically reduced installation costs, plus initial savings of as much as 50% in larger sizes, over similar competitive fittings, are just two of the many reasons why you should specify O. Z. Split Couplings for your difficult conduit coupling jobs.

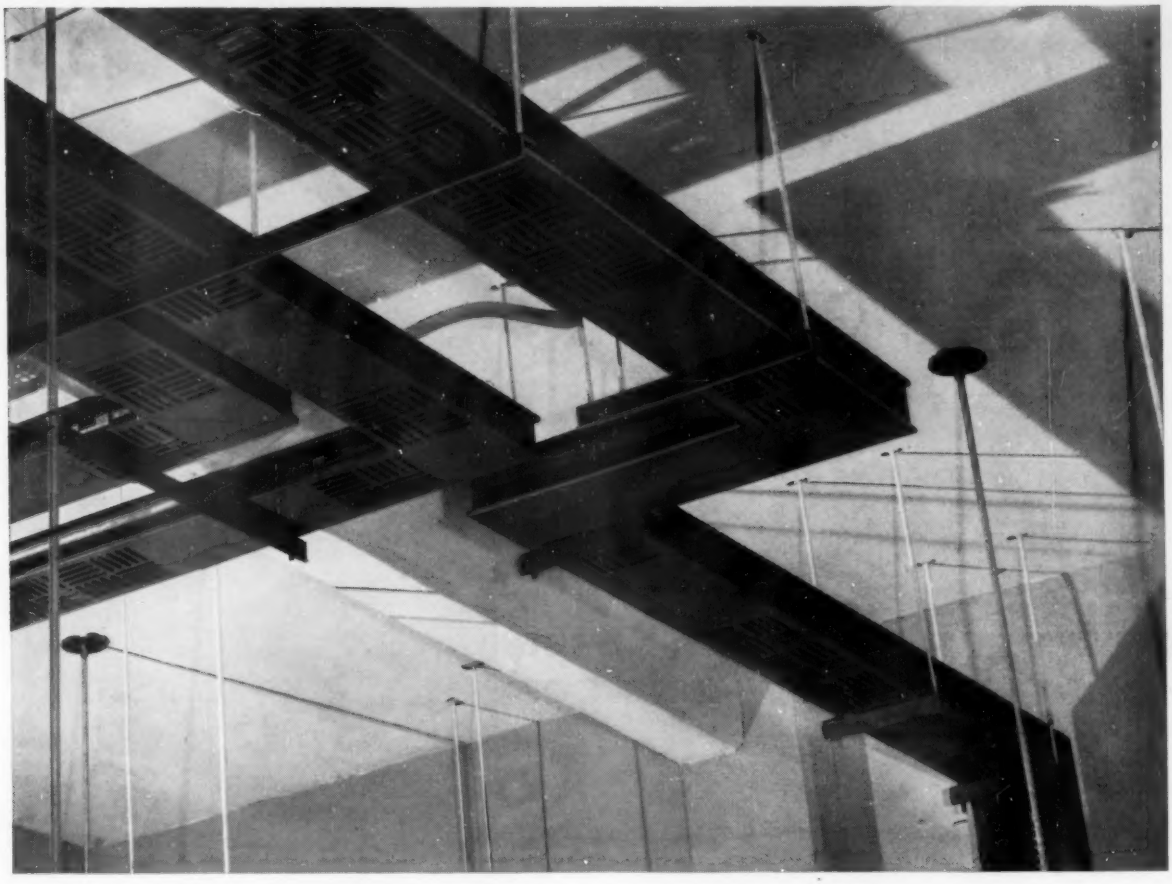
Call your local O. Z. distributor . . . he is ready to make immediate delivery from stock on sizes from ½" to 5".

O. Z. ELECTRICAL MANUFACTURING CO., INC.

262 BOND ST. • BROOKLYN 17, N.Y.

CAST IRON BOXES • SOLDERLESS CONNECTORS
CABLE TERMINATORS • GROUNDING DEVICES
POWER CONNECTORS • CONDUIT FITTINGS

FOR EVERYTHING ELECTRICAL.



New Westinghouse Aluminum bus duct

...LIGHT WEIGHT FOR SIMPLIFIED BUILDING DESIGN

FLEXIBLE...MORE POWER IN LESS SPACE

Tight building layouts and lightweight structural members cause no problem for planning power distribution with new Westinghouse Aluminum Bus Duct. Incorporating all the conveniences and design values of Westinghouse Bus Duct engineering, new aluminum bus duct is *one-third* lighter . . . permitting greater freedom in structural design.

Up to 5000 amperes, Westinghouse Aluminum Bus Duct has greater current carrying capacity, pound for pound, than cable or conduit. It is prefabricated in standard sections . . . installs easily and quickly in any layout, around any obstruction. It fits comfortably into elevator shafts and wireways. When exposed, its modern appearance blends well with interior design.

For detailed information, write for B-6385, Westinghouse Electric Corp., 3 Gateway Center, P. O. Box 868, Pittsburgh 30, Pa.

J-94024

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Design leadership, precision manufacture and rugged quality are three important features that make R & S electrical equipment for hazardous locations, the standard of comparison. Made of materials of outstanding quality, by highly skilled craftsmen, R & S electrical equipment is known and respected by architects, contractors, designers, engineers and maintenance men in all types of industries. Electrical wholesalers prefer to list and sell R & S equipment because these products create prestige, satisfy customers and promote greater sales. Feature for feature, item for item, there is nothing finer for hazardous locations than the R & S complete line.

If you are concerned with the proper application of electrical equipment to eliminate dangers in your hazardous locations, let R & S help you solve any problem.

Sales Representatives in Principal Cities

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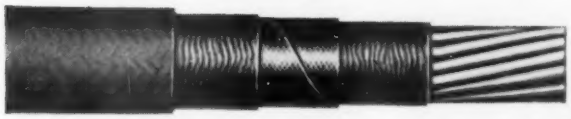

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When you're building your plant, that's the time to install Rockbestos A.V.C. and you will automatically add 30 to 50% more current capacity for future needs.

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Phone or write the nearest branch office for a Rockbestos Field Engineer. He's a wire specialist who can save you time and money on your wiring problems.

STOCKED COAST TO COAST

Standard Rockbestos A.V.C. (N.E.C. types AVA, AVB, etc.) are available from stock for immediate shipment. Call or write nearest branch office.

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NEW HAVEN 4, CONNECTICUT

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PITTSBURGH • ST. LOUIS • LOS ANGELES • NEW ORLEANS
OAKLAND, CALIFORNIA • SEATTLE

a complete line to choose from . . .

Whatever your Time Switch requirements . . . there's a SANGAMO model to answer your needs!

Whether you need a high-quality, heavy duty time switch, a rugged, low-priced one, or a handsome, compact miniature time switch—Sangamo has a complete line of time switches for you to choose from.

Sangamo Heavy Duty Time Switch—Available with synchronous motor—or combined with an *Automatic Carryover* which assures continued operation for up to 10 hours in the event of a power failure. Or you can get it with an *Astronomic Dial* which controls the switching schedule in accordance with sunrise and sunset and also compensates for progressive changes in the seasons.

Unfailing on-off control . . . can take rough handling . . . doesn't need constant attention . . . 450 r. p. m., low-speed, maintenance-free, hysteresis motor . . . long-life silver contacts and bronze bearings at the points of greatest wear.

Low-Priced Type B

Rated at 30 amperes . . . install it and forget it . . . same low-speed motor as the heavy duty model . . . silver contacts . . . bronze bearings . . . easy to install . . . anyone can operate it . . . wiring room in one-half the case . . . ½" to ¾" multiple knockouts.

ST54-5

"Precision in Miniature" Type SR

Compact . . . single-throw . . . single-pole . . . 15 amperes rating . . . attractive . . . adaptable to switchbox mounting.

Interval-Type Timers

Ideal for attic, window and ventilating fans, unit heaters and air conditioning control . . . Type T for wired-in construction . . . Type TJ for portable convenience.

Only Sangamo Time Switches Have Famous Sangamo Quality . . . Give Famous Sangamo Performance!

SANGAMO ELECTRIC COMPANY

SPRINGFIELD. ILLINOIS

FOR EVERYTHING ELECTRICAL . .

Each Spang Representative and his sales personnel throughout the nation now carry this new type conduit display box to present top-quality Spang Conduit.

SPANG® presents

the Case of the Quality Conduit

Here they are . . . Spang's "Big Three" . . . SPANGLEAM EMT, Spang Black and Spang Galvanized (Hot Dipped)! The top-quality conduit designed to help you do a quality job . . . and to give years and years of quality service in every type installation!

Why is Spang so proud of its conduit? Here's why—

QUALITY-MANUFACTURED . . . Only the highest quality steel is selected for Spang Conduit, and it is formed under exact heat conditions with close metallurgical controls rigidly adhered to.

QUALITY-TESTED . . . Spang Conduit is constantly inspected throughout manufacture, and every piece of conduit is *doubly* tested and inspected before delivery.

. . . FOR QUALITY INSTALLATIONS. Spang Conduit is easier to cut, thread, bend and weld, saving you valuable time and money on all your conduit installations.

Take your choice of the "Big Three" . . . Spang Black, Spang Galvanized (Hot Dipped) or SPANGLEAM EMT . . . but be sure to specify Spang. Your Spang Distributor carries the complete Spang Conduit line.

SPANG® CONDUIT

SPANG-CHALFANT
Division of The National Supply Company
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the Emblem of Quality since 1875

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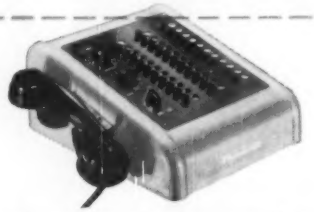
UNIPACT SIGNALS- Need one—or a series of bells, chimes, buzzers or horns? You can have your choice, because these various types of signals are interchangeable; no new wiring is needed. UNI-PACT Signals meet noise level requirements with tailor-made results.

FARADAY FIRE ALARM SYSTEMS. FARADAY Fire Alarms provide *extra* protection. A wide variety of systems to meet all fire warning requirements. Models available for surface or semi-flush installations. FARADAY is known for dependability throughout the industry.

FARADAY CLOCKS. Can be furnished for remote control by master units, or for direct-operating installations. FARADAY models, with exclusive plug-in feature, are supplied for surface, double-dial or flush mounting, in 10, 12 and 15 inch sizes. Easy-to-read dials are white, with bold Arabic numerals.



FARADAY PHONACALL STATION CONTROL UNIT. Features complete volume control, for both talking and listening. Push-button control. Equipped with both audible and visual signal. Compact design. Uses minimum desk space. Distinctive, durable, hammer-tone gray finish.

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BELLS • CLOCKS
BUZZERS • HORNS
CHIMES
VISUAL AND AUDIBLE
PAGING DEVICES
AND SYSTEMS

FOR EVERYTHING ELECTRICAL . .

FIFTY YEARS

of

Saving Time

FOR CONTRACTORS

With Products Designed
To Do

Better Jobs Quicker

HAS BEEN THE RECORD

of

STEEL CITY'S Complete Line of ELECTRICAL BOXES and COVERS*

that has kept pace with changing requirements, not only enables electricians to do *better jobs* but . . . easy-to-remove knockouts . . . brackets, ears and nailholes for most convenient mounting . . . clamps providing free access and positive clamping of wires . . . screws staked to prevent falling out during transit, all combine to save installation time.

STEEL CITY ELECTRIC CO.
1207 Columbus Avenue
PITTSBURGH 33, PA.

STEEL CITY CABLE and CONDUIT FITTINGS*

are designed from a thorough knowledge of their individual needs, meeting their requirements most satisfactorily. The high quality material of which they are made, plus careful inspection along production lines and before packing eliminates loss of installation time due to imperfect fittings reaching the job.

STEEL CITY-KINDORF
Channel, Clamps, Hangers and Concrete Inserts for Supporting Conduit, Lighting Fixtures and Electrical Equipment

—have been designed from a thorough understanding of their requirements and to enable electricians to make conduit installations—from the simplest to the most complex—at a saving of time

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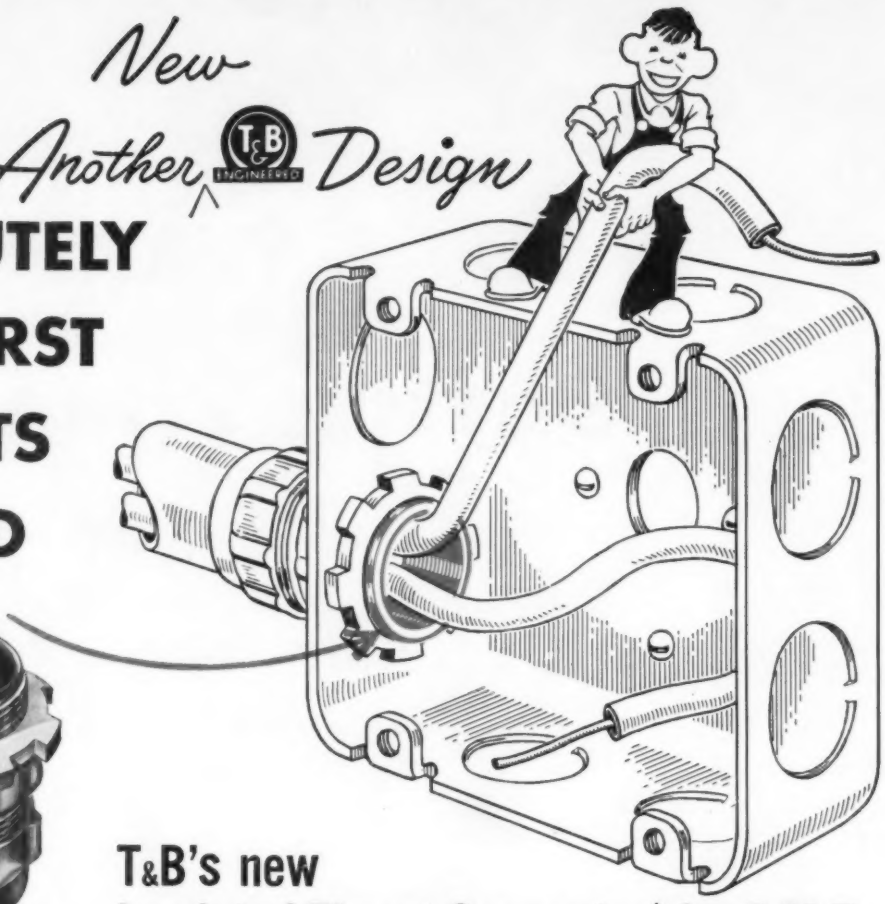

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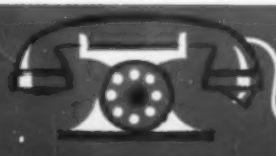

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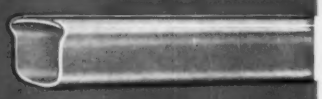

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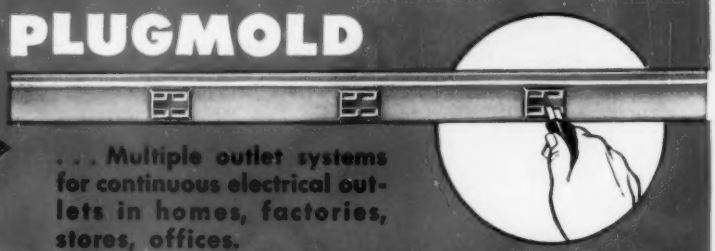

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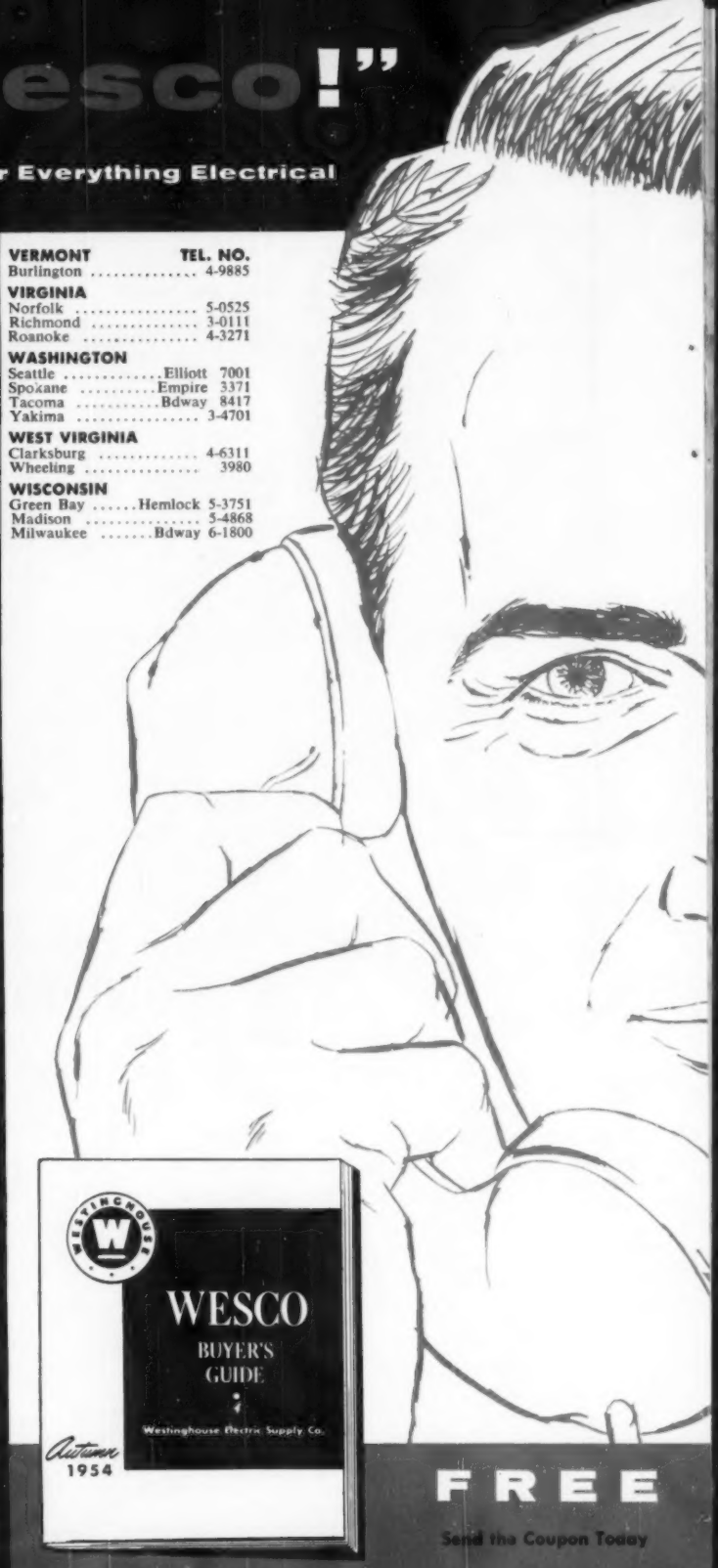

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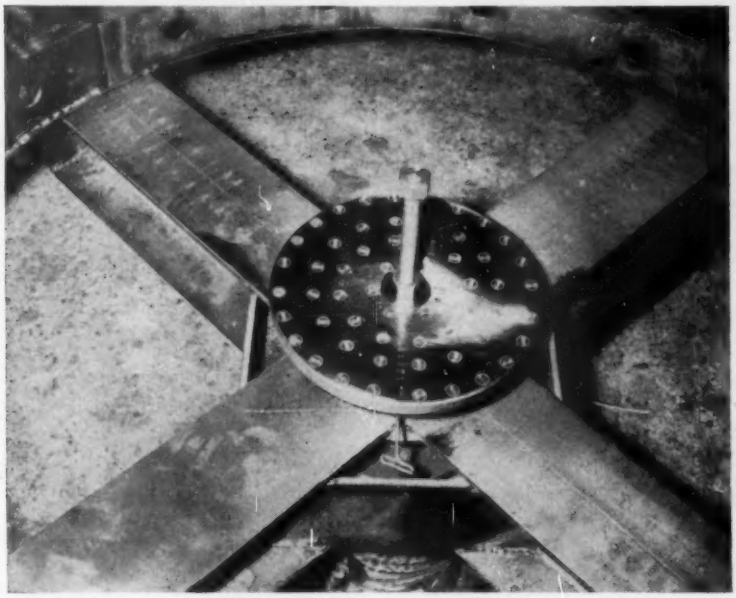
Practical Methods

Magnets Position Assembly Components

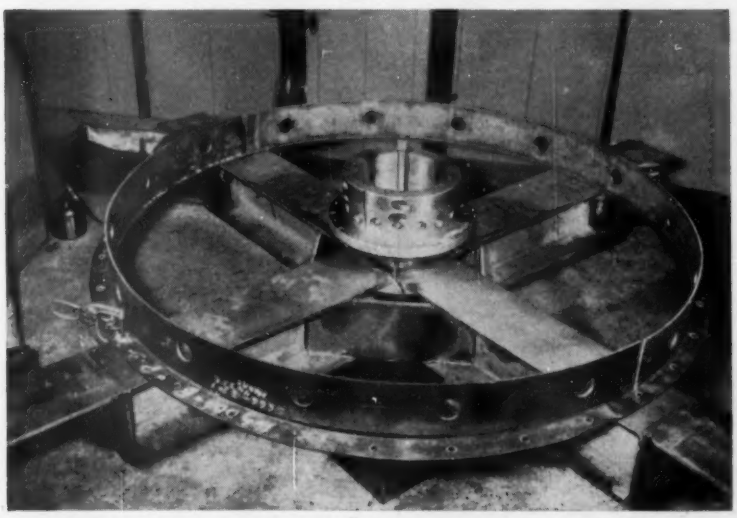
PRODUCTION

The use of magnets to position center hubs during fan assembly is proving to be a valuable time saver in production operations at the American Blower Corporation in Dearborn, Mich.

Welding the vane assembly on fans up to 7 feet in diameter may produce a very unbalanced fan if there is any movement of parts during the operation. American Blower engineers studied the problem and found that the solution lay in rigid positioning of the vane hub. Their jig and fixture men tackled the problem and came up with the idea of using permanent magnets as a holding device.



MAGNETIC HUB PLATE on vane welding jig at American Blower Corporation contains 58 permanent magnets arranged in four concentric circles.



VANE HUB is held rigidly in position by magnets in center plate on welding jig. No clamps are needed. Fan vanes can now be welded to hub and ring without danger of shifting and possible fan unbalance.

They mounted a 16-in. circular steel plate at the center of crossed I-beams which support the fan ring during welding. The plate was drilled to accommodate 58 permanent magnets, each 11/16-in. in diameter. The magnets, manufactured by the Carboloy Dept. of General Electric Co. of the highest energy material commercially available, were installed in these openings and insulated from the plate by thinwall aluminum tubing and washers.

Now this center plate holds the vane hub rigidly while blades are welded in between hub and outer ring. The fixture takes work up to 82¾-in. in diameter without any movement in vane blades, hub or outer ring. Net result: saving in overall assembly time and a substantial contribution to accuracy of assembly operations.

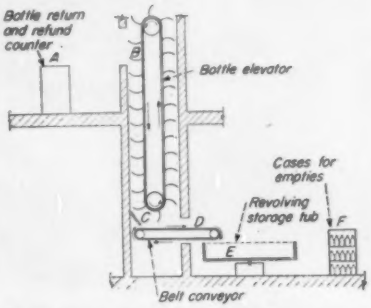
The technique of using both permanent and electro-magnets as simple holding devices for assembly and some machining (particularly grinding, etc.) operations is becoming an established practice in industry. Chances are that a thorough check of your own specific operations might uncover some applications where this method would prove economical.

Motors and Conveyors Boost Supermarket Efficiency

CONTROL

Thanks to a suggestion from Friedman Electric of Boston, the Star Market unit located on Mount Auburn Street in Cambridge, Mass., has been able to conserve some useful space, eliminate confusion, and utilize their available manpower to better advantage. The suggestion pertained to a normally insignificant detail, but when a supermarket grows to the point where a thousand customers are being served simultaneously (see Total Electrical Modernization, EC&M, Aug. 1954), even an "insignificant" detail can become a time-, space-, and personnel-consuming chore. Such was the case at the mammoth Star food center when customers returned their empty carbonated-beverage bottles for refund, for this "detail" called for the full-time attention of several employees to place bottles in cases, shift cases to the shipping room, then bring other

BOTTLE CONVEYOR entrance is located directly behind refund desk on main floor of supermarket, recessed into paneled wall. Edge-lighted sign above counter notifies customers of counter location. Conveyor eliminates piled bottles, keeps premises constantly neat, reduces confusion and labor.



JUDICIOUS use of motors and conveyors conserves manpower and space, eliminates confusion and promotes orderliness in 1000-customer supermarket where empty bottles are transferred from refund counter to shipping room automatically.

empty cases back to the receiving counter.

Now this routine has been eliminated through the use of several fractional-horsepower motors, a compact bottle elevator, an endless-belt conveyor, and a rotating tub in which bottles are temporarily stored in the basement. As indicated in the accompanying sketch, bottles are now returned to the refund counter (A) and are immediately placed on descending cradles (B), being lowered by this motor-driven elevator until they are dumped against a deflecting shield (C) which shunts them on to a motorized belt conveyor (D) moving through the shaft wall to the shipping department. As the bottles drop from the end of the conveyor, they are deposited in

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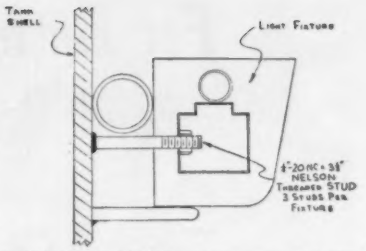
a large tub that can easily be revolved by an attendant as the need arises. Since employees in this department are constantly present, performing other assignments, moving the tub when necessary imposes no great labor burden upon the staff. Then, when the tub is filled, bottles are shifted to empty cases in brief concentrated-effort periods, thereby contributing to the overall efficiency of the operations.

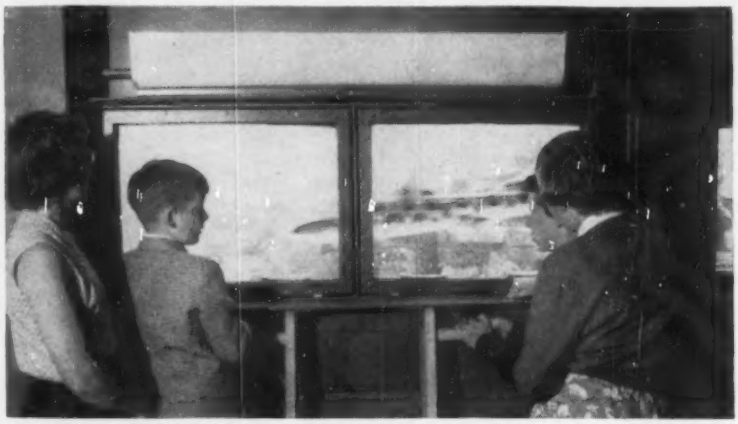


THREADED STUDS, three per lighting fixture, were welded by guns to tank shells without necessity for drilling, tapping and gasketing holes. Channels were then bolted to studs and wired for operation by groups. Lamps are 4-foot 40-watt fluorescents.

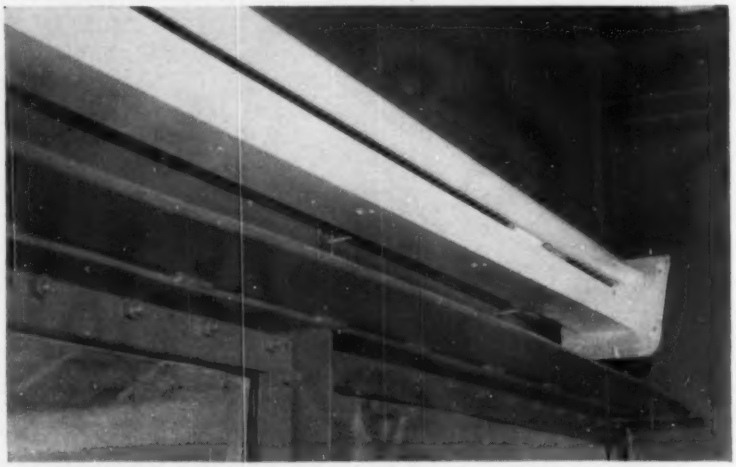
Electrical Contractor Lights Huge Fish Bowls

INSTALLATION

Electrical contractors frequently pop up in unexpected spots with unexpected assignments, as evidenced by the recent activities of Fischbach & Moore at Marineland, Calif. There they were working on a mammoth new Pacific Oceanarium (basically modeled after the famous Marine Studios in Florida), installing pumps, electric heaters, lighting, wiring and controls related to two huge fish tanks, a 1,500-seat viewing amphitheater, adjacent shops, a restaurant, bar and swank hotel for visitors to this new venture on the rugged Catalina Channel. Some idea of the project's size is suggested by the fact that the two main tanks are



LIGHTING FIXTURE over Oceanarium viewing port is held in place by three stainless steel studs applied directly to exterior of fish tanks by means of welding guns. Window frames were secured by stud bolts attached to the shells.



LUMINAIRE REFLECTORS were attached to lighting channels after units were wired and lamped. Windows, 358 in all, are at three viewing levels, the lower ones located 20 feet below the water's surface.

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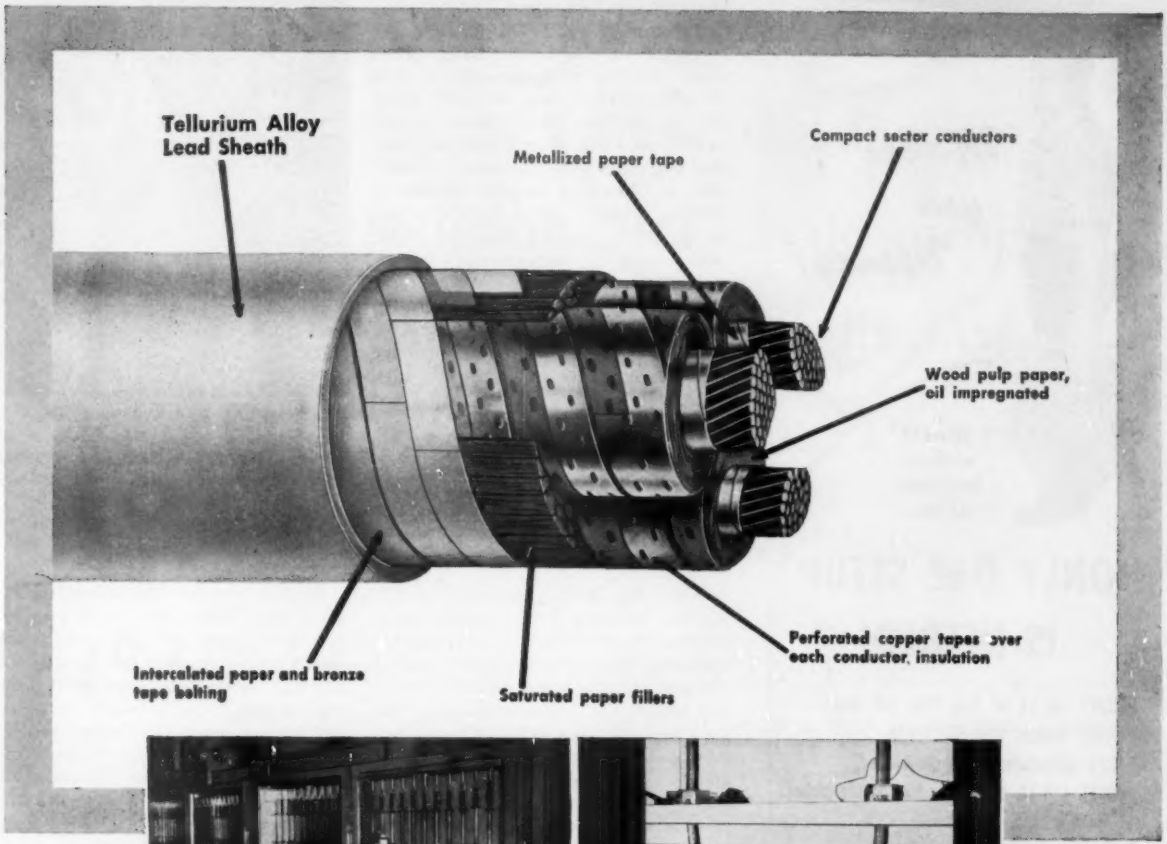

Some of the specially-developed testing equipment with which Roebling maintains quality control of the production of Tellurium Alloy Lead Sheath. #1 Temperature control ovens for creep test of strips cut from tellurium alloy lead cable sheathing.. #2 Temperature control oven for bending fatigue test of full cable section.

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22 feet deep, hold 600,000 and 500,000 gallons of water respectively, contain approximately 5000 fish and sea mammals at present, and are surrounded by three bands of continuous windows (358 in all) at three viewing levels below the water surface.

Since water pressures against the windows are understandably great, each viewing port consists of two thicknesses of special ⅝th-inch glass, held by stainless steel frames secured to the tank shells by stud welding guns. Welding guns were also used by Fischbach & Moore to support fluorescent lighting fixtures above each window, three 3½-by-¼-inch threaded studs being used to support each 4-floor single-lamp luminaire. With these studs, it was possible to attach the lighting channels directly to the outer surfaces of the tanks without drilling and tapping holes in the steel shells, and the procedure greatly speeded this installation routine.

Flat Raceways Used for Elevator Modernization

INSTALLATION

When the 20-story Standard Building in Cleveland, Ohio, recently modernized its ten elevators, considerable additional control wiring was installed between junction boxes located beneath and above the cages supporting the passenger-carrying cabs. These junction boxes were located near the midpoints of the cages, so it was necessary to carry the control wiring out past the sides of the various cabs, then up the outside of the cages. From these junction boxes, flexible conduit radiates to carry control wiring to the panels and devices in the system.

FLAT METAL RACEWAYS, compact in dimensions, rigid, easy to cut and fast to install, were selected to carry control wiring around the outside of elevator cages when the ten passenger cars of Cleveland's Standard Building were recently modernized.

Since it was desirable to keep dimensions of wireways as small as possible, yet have raceways with rigidity and mechanical protection for the circuits, all-steel Surfaceduct was selected for the purpose. This medium was easy and fast to install, the desired rigidity was obtained and reduced clearances were secured due to the flatness of the wireway cross-section. On the ten cabs a total of 250 feet of duct was used, according to electrical foreman Gene Gunsten who supervised the installation for the elevator division of Westinghouse.

CABLE BURYING PLOW on Caterpillar D6 tractor plus reel sled permits two men to bury a mile or more of counterpoise cable per day along Boston Edison Company's transmission lines. Standard tractor tool bar was equipped with sheaves and a modified subsoiler tooth so cable could be fed into ground. A lifting boom raises and lowers bar. Two reels with about one mile of cable are mounted on sled which is dragged behind tractor. Sled also covers and smooths cut made by cable burying tooth.

Kennecott is throwing 121,040,000 punches into your fight for adequate home wiring!

The advertisement on the opposite page means real money to you . . . money from increased wiring and *re-wiring* business!

You'll note that it's an advertisement by Kennecott, and it tells homeowners about one of the many discomforts of living in a home that's inadequately wired.

This is but a single advertisement in a complete campaign of ads now appearing in the pages of *The Saturday Evening Post* and *This Week* magazines. Totaling more than 121,040,000 messages, this great drive for adequate home wiring is hammering home to the homeowner the inconveniences and dangers of weak, undersized, overloaded household wiring.

FREE . . . *Your Own Local Promotion Material!* Send for your copies of brand-new booklet, "The ABC of Home Wiring". Also free newspaper mat ads, reprints, posters.

FREE . . . *New, Handy Check Chart!* Ask for large-size wall chart showing at a glance typical loads and circuits for home wiring.

WRITE Kennecott Copper Corporation, 161 East 42nd Street, New York 17, N. Y.

What was the trouble before?

She couldn't blame her brand-new coffee-maker for working so slowly. The *real* villain was her outdated household wiring! Weak wires... *small* wires. Wires that couldn't carry *full loads* of electricity. Until she *did* something about it, this lady had no end of trouble with the electrical system of her home!

Her lights dimmed whenever she turned on an appliance. Her TV picture had a habit of shrinking in size. Her fuses or circuit breakers kept blowing or tripping too often.

If your own house is 10 or more years old, the odds are 4 to 1 that *you*, too, have these same electrical annoyances. You're *not* getting the most out of *any* of your appliances. What's worse, you're *losing* money in current wasted by undersized, overheated wires.

Even a home that's fully wired today may face electrical starvation tomorrow. One new appliance – like a room air conditioner or a laundry ironer – may overload your wiring!

Why not do what this lady did? Call an electrical contractor or your public utility. Learn how easy it can be, how little it can cost, to modernize your home electrically!

Get FREE booklet!

"The ABC of Home Wiring" tells all about *your* home wiring – and how you can make it serve you better. It's easy to read, fully illustrated, and will be sent to you free of cost. For your copy, write now to Kennecott Copper Corporation, Dept. S7, Box 238, New York 46, N. Y.

Published for your information by **Kennecott**
COPPER CORPORATION

Fabricating Subsidiaries: *CHASE BRASS & COPPER CO., KENNECOTT WIRE & CABLE CO.*

This advertisement, appearing in SATURDAY EVENING POST and THIS WEEK, will reach more than fifteen million readers. It is only one of a regular series of Kennecott advertisements aimed at educating the public to the importance of adequate home wiring.

Motor Shops

Rotating Card Rack Cuts Job Costing Time

The chore of entering costs on motor repair job tickets can be as complicated or simple as individual shop procedures permit. Generally speaking, motor shop operators are beginning to streamline their paper work as much as possible to whittle down overhead. Every time-saving feature economically feasible is being adapted to achieve this goal.

A rotating card rack falls in this category at the motor repair department of the Miller-Seldon Electric Company in Detroit. It is constructed of 12 vertical racks (each 5 in. wide and 39 in. high) mounted on two "wheels" which rotate around a vertical axis. Each rack has 25 slanted "pockets" for job cards. The assembled unit is mounted in the partition between the shop foreman's private office and the shop general office. Both foreman and costing clerk have fingertip access to the racked cards. Walking between offices and thumbing through file boxes or stacks of cards is entirely eliminated.

ROTATING RACK is loaded with job cards by shop foreman Henry Schulz after he gives them a thorough check. He need not move from his desk.

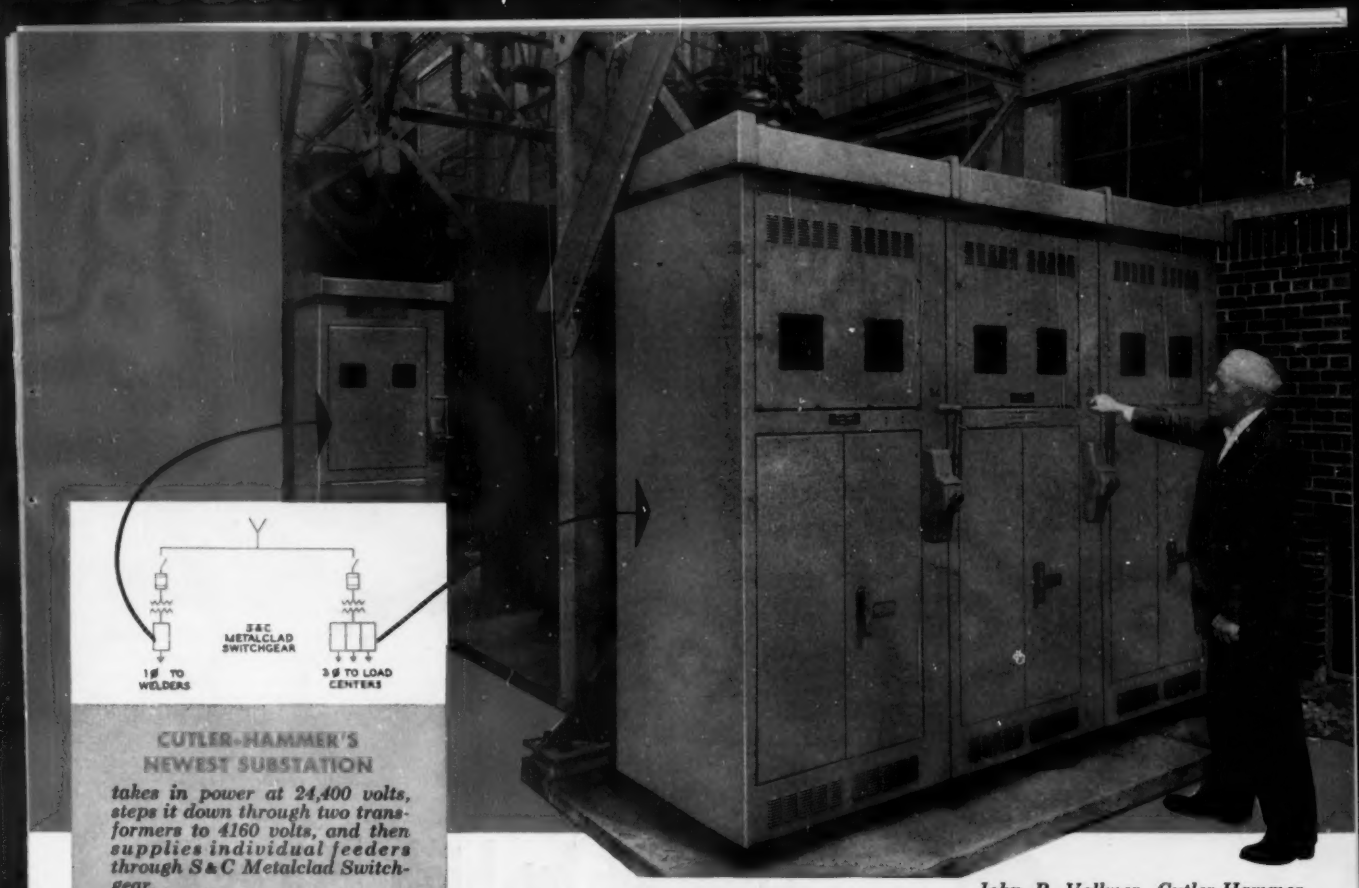
COSTING CLERK TURNS rack and picks job cards to enter employees' time from stamped time slips on desk. She also can be seated at desk during card transfer between the two offices.

The M-S system uses single-fold job cards measuring 4 in. by 6 in. when folded (8 in. by 6 in. open). The printed card provides space for noting customer's name, job number, nameplate data on equipment, work done according to coded list on card and material notations. When opened, the back of the card forms a totalizing record of employees' time spent on the various shop operations involved in the repair job, plus space for total cost of repairs.

As each mechanic completes his work on the repair job, he takes a time slip to the time-clerk's desk, stamps it in a recording clock and drops it in a receiving basket inside the window. The job cards are turned into the shop foreman's office where he checks them and loads them on the rotating rack. Near the end of the day, the costing clerk swings the cards to her side of the partition, picks them from the racks, enters the time-slip data on the back of the cards, and replaces them in the rack. The entire operation is quick, simple and easy. If the repair job is incomplete, the cards are swung back to the foreman's office ready for the next day's assignment.

Welding Dolly Has Sleeve For Rods

Many shops have "home made" carriages for transporting oxygen and acetylene tanks from place to place, yet it is always interesting to run across a new detail relating to the dolly's construction, and to see how imagination and ingenuity can vary or invent a gadget for a particular use. For example, in the shop of Wismer and



CUTLER-HAMMER'S NEWEST SUBSTATION

takes in power at 24,400 volts, steps it down through two transformers to 4160 volts, and then supplies individual feeders through S&C Metalclad Switchgear.

John P. Vollmer, Cutler-Hammer chief plant electrician, at the main substation

SAVES 50%

BY SELECTING S&C METALCLAD SWITCHGEAR

To protect and switch high voltage feeders at the main substations

MR. CHARLES WELCH

is plant engineer for Cutler-Hammer, in charge of five plants including the newest at 30th Street, Milwaukee. He says "S&C meets our standard of quality, and we haven't had a single failure of S&C equipment since we first started using it back in 1938. The S&C Switchgear we selected for the new plant fits our needs exactly."

Charles Welch, Cutler-Hammer's chief plant engineer, cut equipment cost in half when he selected S&C Metalclad Switchgear for Cutler-Hammer's newest Milwaukee plant.

A 15-year record of *no failures* in four other plants proved conclusively that this S&C gear would meet the most rigid service requirements in the new plant. Today, heavy production schedules are maintained without interruption of power, and S&C gear continues its unfailing record.

You, too, can make savings of this kind and meet your requirements exactly by specifying S&C Metalclad Switchgear. Full information is contained in this booklet. We would like to send a copy to you.

S&C Electric Company
4433 Ravenswood Ave., Chicago 40, Illinois

Please send me your booklet on S&C Metalclad Switchgear. **No** obligation on my part, of course.

Name_____ Title_____
Company_____
Address_____
City_____ Zone____ State_____

Trapped by high Prices?

...Try Circle F!

Snap! . . . There's another fellow trapped by high costs! Easy to avoid. Just order Circle F! No high prices there – Just top quality Guaranteed Wiring Devices at an easy-on-the-pocket price. Send for our catalog No. 18 and see for yourself. Order Circle F . . . and save!

852-O

Bakelite Pull Receptacle. Combination 3¼" – 4". Three piece – Shadeholder Groove. Open double terminals for continuous wiring. 250W – 250V

202-O

Bakelite Keyless outlet box receptacle. Combination 3¼" – 4". Flush back – Open double terminals for continuous wiring – Shadeholder Groove 660W – 250V

213-O

Porcelain Keyless outlet box receptacle. Open terminals. Flush back with Shadeholder Groove. 660 watts-250 volts. Supplied with drain holes to meet R.E.A. specifications. For 3¼" or 4" box.

864-SO

Porcelain Pull Receptacle. Convenience outlet in base and Shadeholder Groove. 250 watts-250 volts. For 3¼" or 4" box. Available with pendant or insulator.

Circle F Mfg. Co.

TRENTON 4, N. J.

Saving You More Since 1904

50 YEARS

HANDY HOLDER for welding rods is made from a length of pipe, sealed at the bottom by an angle clip, and welded to the dolly frame. Various hooks, shelves, braces and castors give this standard shop item a few new twists.

Becker, Sacramento, Calif., the dolly supporting tanks has a sleeve on one side to hold welding rods in an always-at-hand convenient location. This sleeve is merely a short length of pipe, welded to the frame of the carriage, and sealed at the bottom by a section of angle iron.

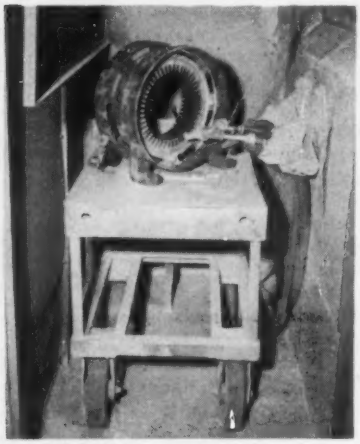
On this same carriage, handles were formed by welding short lengths of conduit on the upper ends of the dolly's side pieces, and facilities for holding goggles, hoses, the torch and other related equipment were provided by tacking on varying rod hooks and channel-formed shelves. Roller bearing castors make movement smooth and easy.

Walk-In Booth For Sand Blasting

Motor shops use various methods to clean motors and component parts before rewinding and reassembly. Among them are degreasing and sand blasting. Each has its own advantages for specific operations. To assure that every item leaving the shop is perfectly clean, Howard Electric Company in Detroit maintains both types of equipment in its motor repair department.

Sand blasting is performed in a free-standing booth constructed of sheet metal and lined with abrasive-resistant material. The walk-in enclosure is 3-feet wide, 6½-feet high and 5½-feet long. A full-length, full-width hinged door at one end provides access for loading the booth with small or large stators on rolling tables or low dollies. Two lamps, with protective glass

LONG TILTED WINDOW gives operator full view of work being cleaned inside walk-in sand blast booth at Howard Electric Company. Front end of booth (left) is a hinged door.

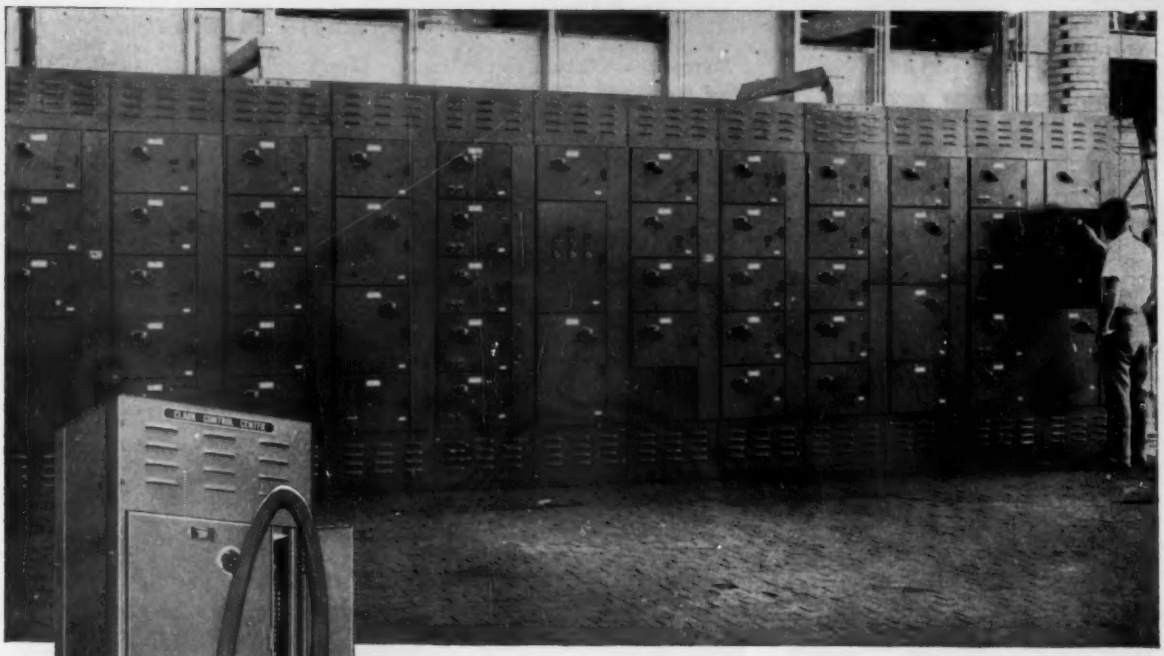


SPRING-SUSPENDED NOZZLE gives operator, wearing heavy rubber gloves full freedom to direct sand blast at and around stator. Small motors are placed on rolling table, large units on low dollies.

globes, provide adequate interior illumination. An exhaust system removes dust from the booth.

The operator stands at one side of the enclosure and manipulates the nozzle through two hand-holes equipped with protective sleeves protruding into the booth. As an added precaution, he wears heavy rubber gloves. A spring-suspension arrangement holds the nozzle at hand-hole height and gives the operator full freedom to play blast of sand at and around the stator.

Full view of the booth interior is provided by a 48-in. by 12-in. glass window mounted directly above the hand-holes at approximately shoulder height. The window tilts outward about 30 degrees to the vertical so the operator can see the lower part of the booth when working on large diameter stators.



Top: Clark Control Center for furnace control at Bohn Aluminum and Brass Corporation, Adrian, Michigan.

Insert: Separate access doors to vertical wireways simplify installation, inspection, service and maintenance.

SEPARATE VERTICAL WIREWAYS

Simplify installation and servicing of

CLARK CONTROL CENTERS

Roomy 6-inch wide vertical wireways for each section, independent of starter compartments and equipped with separate access doors, save time and money on installation of Clark Control Centers, and make them easier to service and maintain.

Ample wiring space is provided for all load and interwiring connections. Terminal boards may be located in vertical wireway adjacent to starters or at top or bottom of any section. Versatile bus-bar compartments permit the use of one to four sets of electrically isolated horizontal bus, permitting power to be fed from any or all of four different sources.

Clark Control Centers are the easiest to pre-plan and lay out because adding transformers and/or relays or changing type of construction (NEMA type A, B, or C) does not change space requirements.

Write for your copy of the 24 page illustrated book entitled "Control Centers by CLARK."

The **CLARK** **CONTROLLER** *Company*

Engineered Electrical Control

1146 East 152nd Street • • Cleveland 10, Ohio

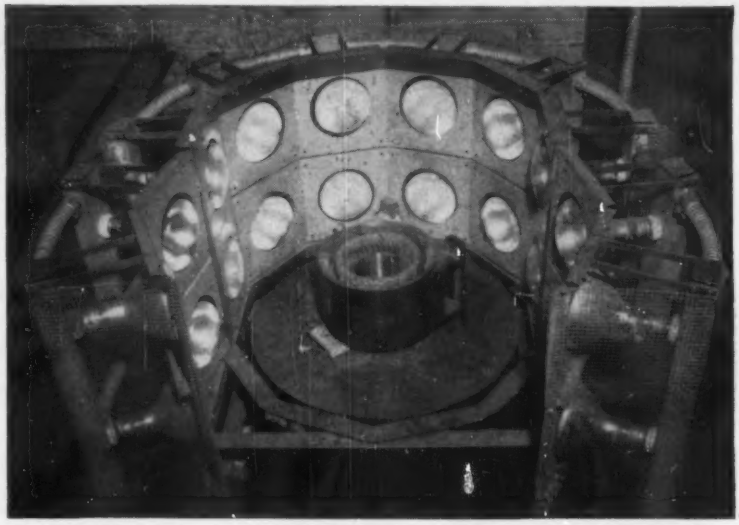
Work Rotates in Electric Bake Oven

More uniform heating and baking of stator coils is obtained by rotating the work inside a ring of infrared lamps in the motor repair department of Clement Electric Company, Grand Rapids, Mich. That is why shop superintendent Paul D. Bogdan designed and built an auxiliary table-type, infrared oven complete with motor-driven turntable to accommodate the smaller size motors. Now work can be processed without the danger of possible hot spots created by lamp beam concentration.

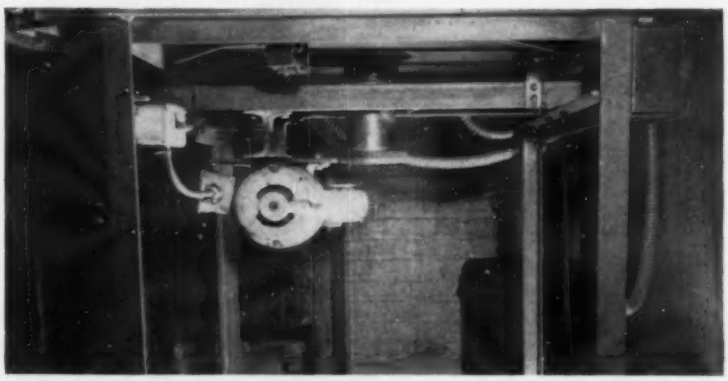
The heat ring is decagonal in shape and contains two rows (ten lamps per row) of 250-watt, reflector-type, industrial infrared heat lamps. Each of the ten panels in the ring has two lamps (one above the other) projecting slightly through a flat sheet-metal reflecting surface. An angle-iron and flat-iron frame behind each panel supports the socket and wiring trough for the two lamps. Adjacent groups of lamps are interconnected with flexible conduit.

The complete lamp ring is mounted on a base frame consisting of two parts: (1) an inner decagonal angle-iron ring (1½-in. stock) whose shape matches the inner contour of the lamp ring; and (2) a 26½-in. square angle-iron supporting frame mounted on four 36½-in. legs of the same stock. Six of the lamp panels are permanently fastened to the inner ring. Two adjacent groups of two panels (four lamps) are hinged and swing outward to provide access for side loading of the bake oven.

A 22½-in. diameter turntable of ¼-in. steel plate rotates inside the inner ring support. It is driven at about 12 rpm by a ⅛-hp, 110-volt, single phase, gear-head motor mounted under the table



STATOR TURNS slowly on revolving base inside a dual ring of 250-watt heat lamps. More uniform baking and elimination of "hot spots" result. Note how hinged lamp panels at front swing out for side loading of oven. Lamps, sockets and wiring are protected by wire mesh screen.



GEAR-HEAD motor under unit drives turntable at about 12 rpm through V-belt connection to table shaft extension. Outer edge of table rides on four supporting "wheels" on underside of frame to add rigidity to assembly.

It's Brand New

National Electric Superduct

Super Protection Against Toughest Corrosive Conditions

Independent Tests* Conducted by Pittsburgh Testing Laboratory Show NE's New Superduct—

- **Reduces Maintenance to a Minimum**
- **Eliminates Conduit Repairs**
- **Prevents Production Downtime for Corroded Conduit Replacements**

***WRITE TODAY**

Get the complete facts about Superduct Rigid Conduit including actual test reports of Pittsburgh Testing Laboratory's Sulfuric Acid, Salt Spray, Caustic and Heat Tests.

Be prepared for the next conduit installation where heavy-duty corrosion protection is essential.

Listed by Underwriters' Laboratories, Inc.

WHAT IT IS

Superduct is National Electric's new heavy-duty rigid steel conduit. *It has all the corrosion protection provided by the Sherardizing process of galvanizing plus a special baked-on resin synthetic base coating.* The result: NE Superduct is ideally suited for installations wherever wide temperature ranges or excessive corrosion from acids, caustics or moisture is just too rough for even the best regular conduit.

WHAT IT PROVIDES

Heavy-Duty Corrosion Protection

SUPERDUCT

Resists corrosive action of almost all chemicals, oils, greases, moisture and weathering conditions.

Does not corrode or rust when buried in the ground.

Resistance to Temperature Change

SUPERDUCT

Unaffected by extremes of ambient temperatures.

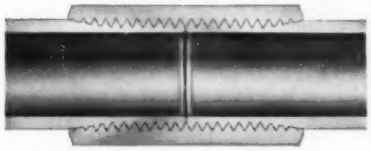
Stands up under conditions of high temperatures and high humidity.

Smooth Working and Fishing

SUPERDUCT

Has all the easier working, forming and bending properties resulting from the Sherardizing process of galvanizing.

Like Sherarduct, SUPERDUCT couplings are designed to allow the conduit ends to butt within the coupling . . . permits solidly locked, easily fished, thoroughly grounded system.



Complete Thread Protection

Every hill and valley of Superduct threads and couplings has full protection of both zinc and special vinyl resin enamel.

EVERYTHING IN WIRING POINTS TO

National Electric Products

PITTSBURGH, PA.

3 Plants • 8 Warehouses • 34 Sales Offices

SPECIFY LIFE-TIME PROTECTION NATIONAL ELECTRIC SHERARDUCT

Rigid Steel Conduit

Sherardizing is Galvanizing at its best

Sherarduct is Galvanized Conduit at its best

HERE'S WHY—

1 It's the Sherardizing process that fortifies Sherarduct against rust and corrosion. This process drives a pure zinc coating into the steel surface—alloys the coating to the steel wall.

2 Still further protection is provided by the baked-on Shera-enamel coating that seals the zinc—fortifies SHERARDUCT against acids and other corrosive elements.

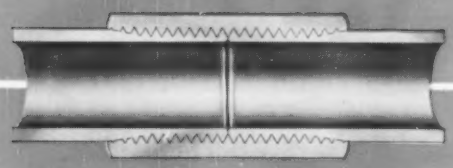
3 Even the base of the clean, sharp threads of Sherarduct Rigid Steel Conduit have full zinc protection. No need to worry about threads rusting even before you install it—not when you use SHERARDUCT!

THE SHERARDUCT COUPLING

. . . all surfaces and threads are zinc protected same as the conduit.

. . . accurately undercut threads permit completely closed joints . . . no raw threads exposed. No gaps to interfere with "easy fishing."

. . . further protected by baked-on Shera-enamel coating. Fully protected where danger of corrosion is greatest in conduit systems.



EVERYTHING IN WIRING POINTS TO

National Electric Products

PITTSBURGH, PA.

3 PLANTS • 8 WAREHOUSES • 34 SALES OFFICES

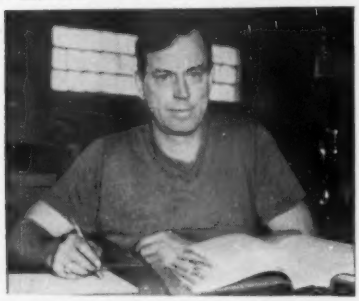
TABLE-TOP infrared ring complete with turntable base provides handy auxiliary bake oven facility in the motor repair shop at Clement Electric Company, Grand Rapids, Mich. Controls are on main oven at right.

and V-belt connected to the base of the turntable shaft. This shaft is a length of 3-in. steel tubing machined to fit a roller bearing mount. The outer edge of the turntable rides on four anti-tilt ball-bearing "wheels".

Maintenance ease is a feature of the oven design. The turntable can be quickly lifted out of the frame for cleaning. All lamp sockets and wiring connections are accessible from outside the ring and are enclosed by a wire screen to prevent accidental breakage.

Basic electrical connections consist of four lamps in series on a 440-volt circuit. Each of five circuits serving the ring are controlled from a central point at the large bake oven adjacent to the auxiliary infrared unit. Circuit and switching arrangements provide a measure of flexibility in operating the upper and lower rows of lamps.

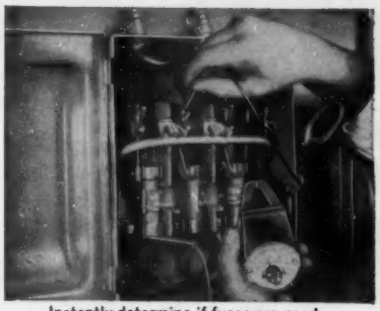
Motor stators up to 15 and 20 hp, 1,800 and 3,600 rpm size have been baked in the turntable unit. Average time under the lamps ranges from one to three hours depending upon size.



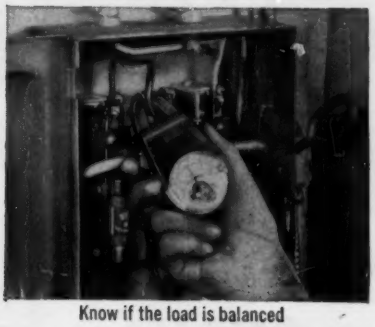
JUSTLY PROUD of his new 3,200-sq. ft. one-story motor repair shop is Frank W. Ross of Fairmont, Minn. A member of the NISA Board of Directors and Chairman of the 1955 NISA Awards Committee, Ross is a firm believer in labor-saving techniques and has developed many useful shop ideas.

Check appliance current at receptacle

Trouble-shoot relays quickly

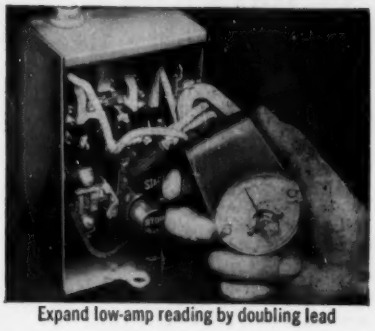


Instantly determine if fuses are good



Know if the load is balanced

Know if windings are grounded



Expand low-amp reading by doubling lead

MAGNETIC FREQUENCY MULTIPLIERS

[FROM PAGE 91]

and multiplier continuous current rating. The output voltage is enough to start 96-inch cold cathode lamps without auxiliary means.

Power Factor and Efficiency

The uncorrected power factor of the load drawn by the frequency multiplier is necessarily low (about 30% lagging at full lamp load). This may be increased to 95% or better by addition of a power factor correction assembly. This accessory unit contains the required capacitors and filter reactors. The unit is enclosed in a separate steel case, approximately 21 in. by 16 in. by 16 in. high, and weighs 130 pounds. Provision is made on the frequency multiplier terminal board for connection of the power factor correction unit at the output side of the line switch, so the correction unit will be switched on and off with the multiplier.

The efficiency of the multiplier in transforming incoming line watts to actual lamp watts at full load is 72%. Additional losses with power factor correction reduce this to 70%. The overall efficiency of light production with the recommended lamps is approximately the same as realized from 60-cycle conventional ballasts.

Applications

Two converters of the type described in this article (Fig. 4) are in operation for experimental plant growth at the United States Department of Agriculture, Plant Industry Station at Beltsville, Md. A number of similar special installations are being planned. Widespread use of this advantageous means of frequency conversion will depend upon a reduction of initial cost for a more favorable economic comparison with the 60-cycle system.

SERIOUS DISCUSSION on economic trends and future of the electric industry was under way between C. G. Keenan, Dept. of Water Supply, Gas & Electric, City of New York and Edward A. Bracher, electrical inspector, N. Y. Board of Fire Underwriters, Brooklyn, N. Y., during Eastern Section IAEI annual meeting at Atlantic City.

$971 saved on Wiremold raceway installation with REMINGTON STUD DRIVER

Powder-actuated tool does 4-week fastening job in 3 days!

Only one week could be spared to install microphone stands at the Naval War College, Newport, R. I. Yet the 400 fastenings required for Wiremold raceways meant 4 weeks of drilling to set anchors. It looked hopeless until an electrical contractor with a Remington Stud Driver bid on the job.

Setting up to 5 studs a minute, the Stud Driver helped finish the installation in just 3 days! Each of the 400 studs was set in a few seconds; the raceways were anchored *permanently*. Cost, including labor, cartridges and studs was $321 compared to an estimated $1,292 for the old method. A saving of $971 or 75%!

Take advantage of the cartridge-powered Remington Stud Driver to bid lower, work faster on all sorts of installations—including switch boxes, conduit, and overhead lighting fixtures. The tool is lightweight (6 lbs.) and needs no cables or wires. You carry the power in your pocket! Clip coupon for complete information.

TYPICAL QUESTION FROM A CONTRACTOR

Q. *Is there a way of fastening switch and outlet boxes with just one stud?*

A. *There sure is! With our new cupped washer, you can easily position and secure the box with one stud. Outlet box can be removed later if desired. We'll be glad to send you our booklet on the cupped washer.*

MAIL THIS COUPON TODAY

Industrial Sales Division, Dept. ECM-11
Remington Arms Company, Inc.
Bridgeport 2, Connecticut

Please send me free copies of your general information and Wiremold raceways booklets showing how I can cut my fastening costs.

- ☐ How to Install Wiremold Raceway
- ☐ How to Install Outlet & Utility Boxes with Cupped Washer
- ☐ Catalog and Price List

*Name*_____

*Position*_____

*Firm*_____

*Address*_____

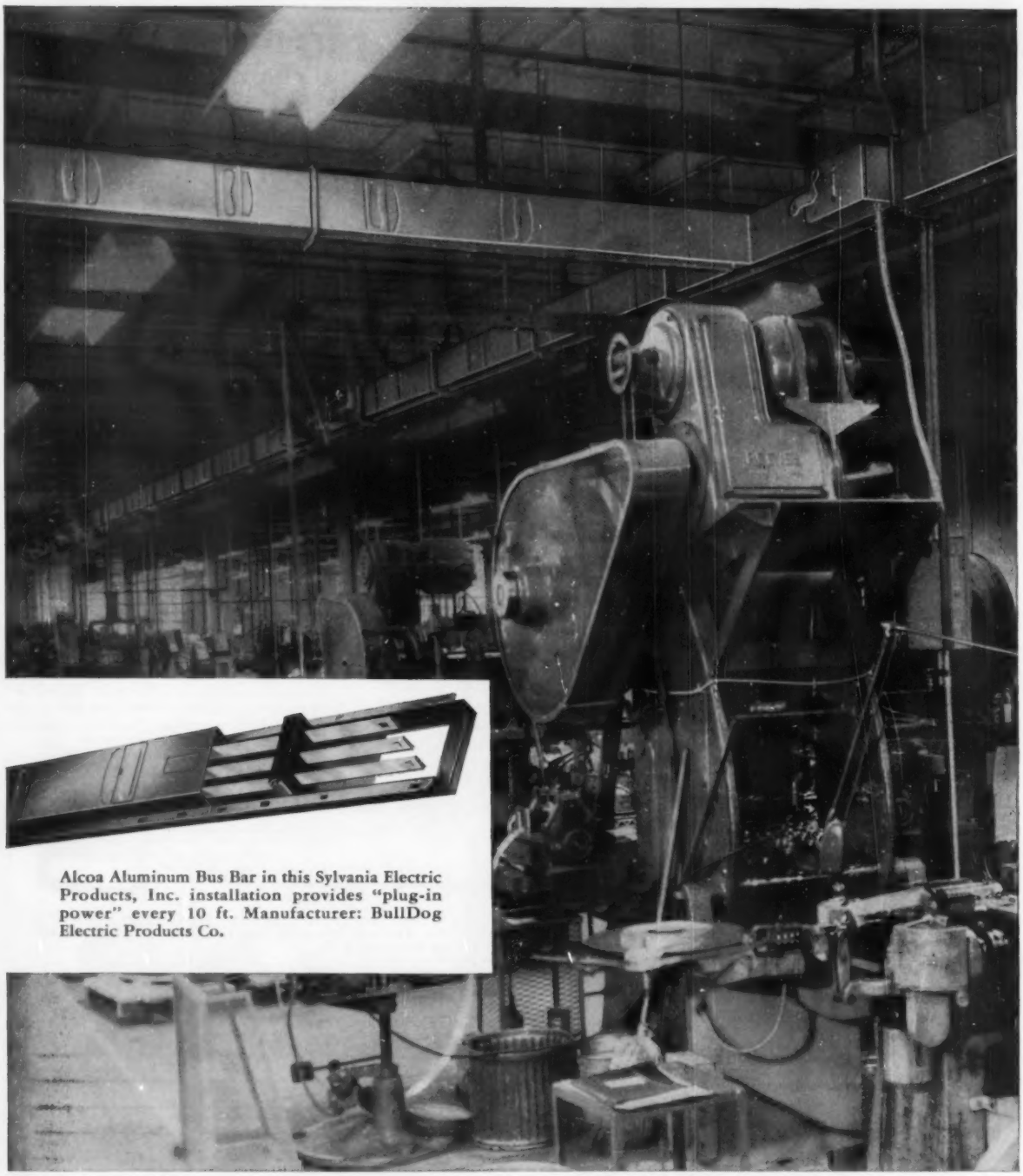
*City*_____ *State*_____

"If It's Remington—It's Right!"

Remington DUPONT

Listed & Approved by Underwriters' Laboratories, Inc.

NEW Alcoa bus conductor makes systems stronger, lighter;



Alcoa Aluminum Bus Bar in this Sylvania Electric Products, Inc. installation provides "plug-in power" every 10 ft. Manufacturer: BullDog Electric Products Co.

bus duct saves costs

Using Alcoa's new No. 2 EC* aluminum bus bars, manufacturers of bus duct systems now can provide you with the most favorable combination of strength, light weight and conductivity at a significant saving in cost.

Alcoa developed this new alloy to meet the demands of distribution bus and isolated phase construction for higher yield strength and better creep characteristics than could be obtained with EC metal. The result is yield strength of 25,000 psi for greater resistance to deformation by short-circuit current surges . . . a compressive creep rate substantially improved over EC . . . and conductivity of 57 per cent IACS.

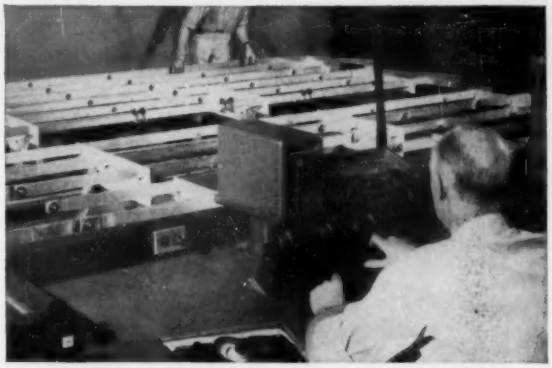
In bus duct systems, the light weight of No. 2 EC —almost 50 per cent under that of copper—permits the use of simpler and less expensive supporting structures, besides permitting appreciable savings on installation or relocation. Equally important, manufacturers using this new Alcoa bus conductor can save you approximately 10 per cent on your initial investment.

Wherever your production requirements demand an efficient, flexible electrical distribution system, specify bus duct with Alcoa® Aluminum Bus Bar. This dependable product is the result of 59 years of experience, beginning with the world's first aluminum bus bar installation. Use the coupon below to get the names of manufacturers offering bus duct with Alcoa Aluminum Bus Bar.

ALCOA ALUMINUM

ALUMINUM COMPANY OF AMERICA

Tensile properties of Alcoa's No. 2 EC alloy for bus bars are checked on this Baldwin-Southwark tension testing machine, periodically calibrated to assure precision.



A precision potentiometer records the voltage drop on test sections of Alcoa Aluminum Bus Bar in the Massena, N. Y., laboratories, world's largest facility for aluminum conductor research.

***PROPERTIES of No. 2 EC-T8**

Tensile Strength, psi	Yield Strength, psi
Minimum—29,000	Minimum—25,000

Conductivity—57 per cent IACS

Aluminum Company of America
2108-L Alcoa Building
Pittsburgh 19, Pennsylvania

Please send me the names of manufacturers offering bus duct systems using Alcoa Aluminum Bus Bar.

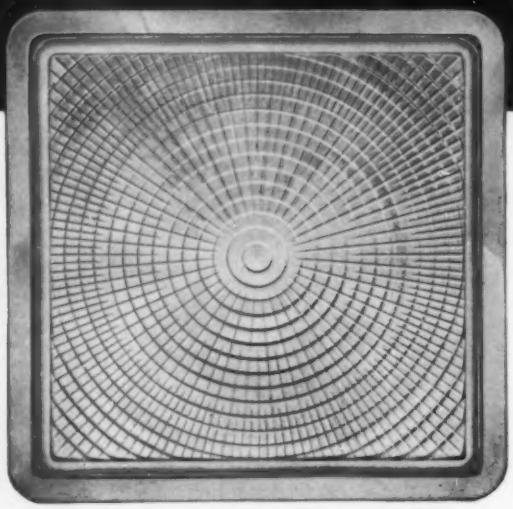
Name_____

Company_____

Address_____

City_____ State_____

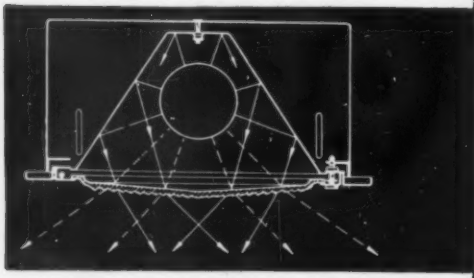
ART METAL advanced ELIPTISQUARE



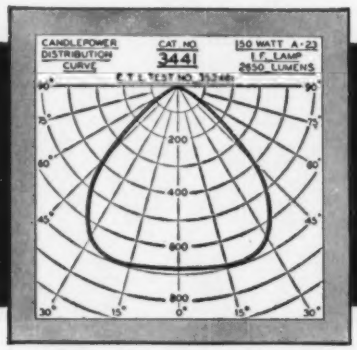
with clear, prismatic AMCOLENS

- Lighted objects reflect their true color value
- Highest light transmission efficiency
- Precise light direction control
- Edge light to ceiling for visual comfort
- Shallow recessed lens lighting

advanced ELIPTISQUARE
Multiplies Light Output



Eliptisquare reflector redirects *all* box-enclosed light downward through AMCOLENS to multiply lamp light utilization.



Please notice that the candlepower distribution curve is by Electrical Testing Laboratories, Inc., not The ART METAL Company.

May we send Bulletin 254 which gives complete details? Please write:

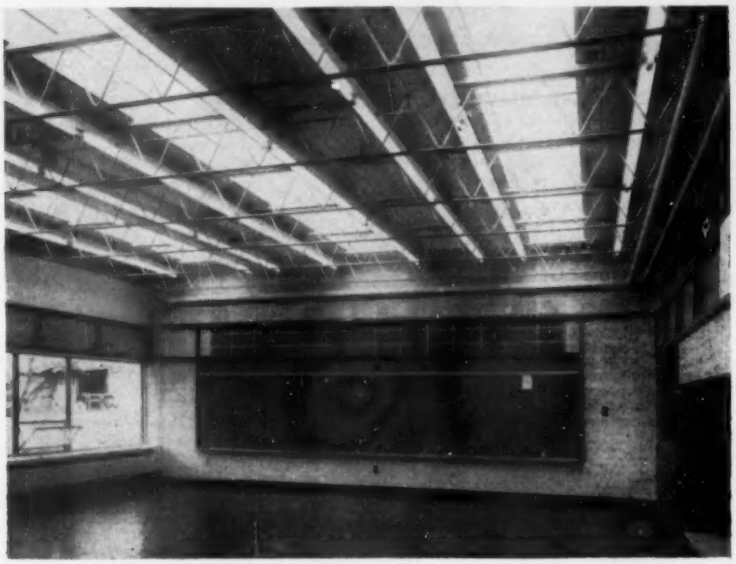
THE **ART METAL** COMPANY
CLEVELAND 3, OHIO

Manufacturers of Engineered Incandescent Lighting

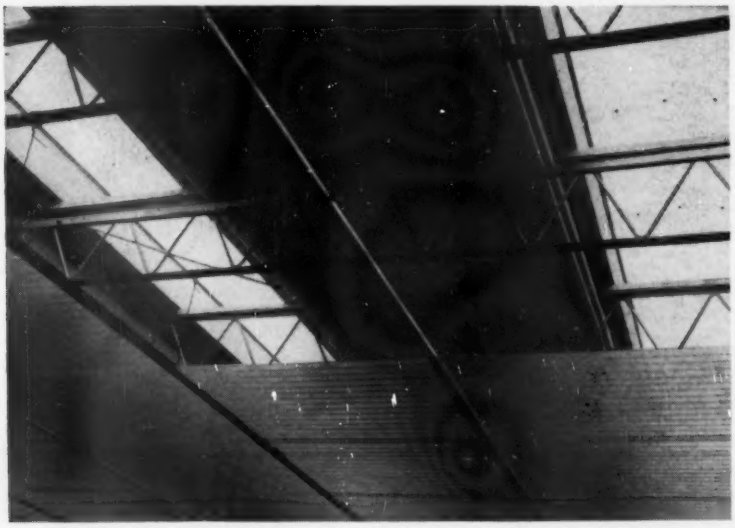
Modern Lighting

Award-Winning School Combines Artificial and Natural Lighting

Recent national recognition in the form of a 1954 A.I.A. Merit Award has directed considerable attention to new ideas in lighting, construction and acoustical treatments incorporated in the design of the new Lakeview Elementary School on Mercer Island, Wash. Framed of welded steel and using color in comment-creating combinations, the classrooms are lighted by a combination of natural and artificial illumination that provides over 300 footcandles to desktops during normal daylight hours.



THREE CONTINUOUS SKYLIGHTS plus eight rows of slimline lamps combine to provide over 300 footcandles of diffused illumination to desk tops in this classroom. Louvered canopies above windows shield students from direct rays of sun, while translucent skylights and plastic suspended ceiling panels doubly diffuses natural light entering rooms from above.

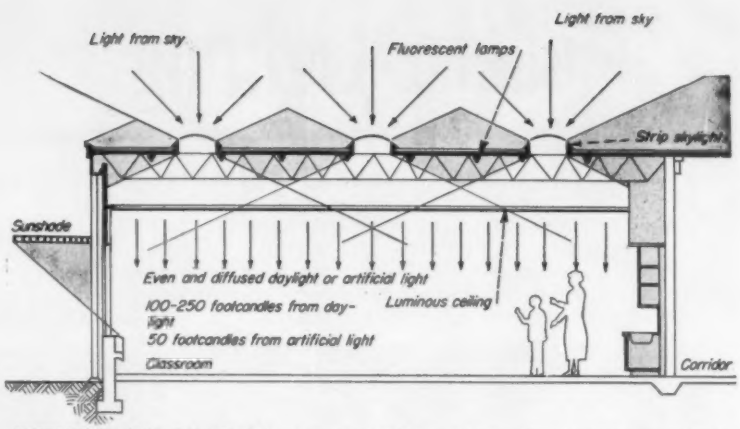


INVERTED T-BAR FRAMING for suspended translucent corrugated plastic ceiling is in turn suspended from roof trusses by means of wire hangers. Each 24-foot-long row of lamps consists of three 8-ft, one 6-ft and one 4-ft tube mounted end-to-end.

Reflected light from the sky is admitted to one side of the room through huge window areas, although direct rays are excluded by vertical-louvered sunshade canopies erected above these large glass wall panels. Natural light also enters the classrooms through arched corrugated-plastic translucent skylights, that span the rooms as continuous 24-inch-wide strips installed on approximate 9-foot centers. This spacing arrangement effectively opens up over 20% of the entire roof area for the entrance of skylight and, varying with the seasons and climatic conditions, the resultant illumination from this natural source ranges from 100 to over 250 footcandles. This natural light is twice diffused before reaching normal eye level: once when it passes through the corrugated translucent skylight strips, and again when it continues through the translucent corrugated plastic ceiling panels which are suspended 3 feet beneath the roof decks and 9 feet above the room floors.

Artificial illumination is provided by eight rows of slimline lamps, each row measuring 24 feet in length and consisting of three 8-foot, one 6-foot and one 4-foot tube, all mounted end-to-end. Rows generally are 3½ feet apart although, to keep the area immediately beneath the innermost skylight clear, two of the rows on the side of the classroom farthest from the windows are mounted only 30 inches on center. From this artificial source the classrooms obtain an additional 50 footcandles when required during overcast days or in the evenings for P.T.A. meetings or other civic gatherings.

Ceiling panels are supported by inverted T-bar framing members which in turn are secured at desired elevations by means of wire hangers extending downwards from steel bar-and-angle-formed roof trusses. This method of suspension greatly minimized lighting installation charges and contributed, along with numerous other electrical and structural economies, to the attainment of a reasonable overall building cost of $11.60 per square foot. This overall charge, incidentally, includes all normally-included expenses related to a steel and brick school building, plus an oversized



SHIELDING AND DIFFUSION of natural light is obtained by louvered sunshade, translucent skylights and suspended plastic ceiling. Ceiling height above floor is approximately 9 feet, and it is 3 feet beneath the roof level.

heating system to take care of expected future additions, a complete self-contained sewage disposal system, and extensive all-weather outdoor playground paving.

Designed by architects Bassetti, Morse & Aitken and erected by the E. F. Shuck Construction Company, this award-winning school was wired and lighted by the Industrial Electric Company, all of these firms being located in Seattle. Electrical consultant on the project was Ben B. Lezin of San Francisco.

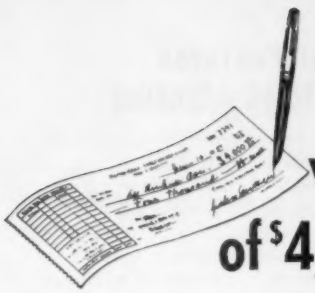
350 Footcandles Provide Judging Brilliance

The use of local lighting at the finish line of an up-state New York harness racing track has greatly boosted the footcandles delivered to this critical area and, at the same time, has reduced overall wattage—resulting in a saving of about 70% in operating charges.

While most tracks illuminate the finish line area through the use of 10,000-watt searchlights mounted on the roof of the grandstand, this installation uses four searchlight units containing only 3000-watt lamps. This has cut replacement costs materially, since the lower-wattage bulbs cost about half and have at least a third more life than the normally-used larger lamps.

As the horses and sulkies swing into the home stretch, however, six additional pole-mounted floodlights, located 50 feet above the track on the infield side, are brought up from half to full power, combining with the four stand-topping searchlights to deliver a brilliant 350 footcandles for exact judging and photo-finish verification.

This lighting job was installed by electrical contractors Langdon & Hughes of Utica, in accordance with Crouse-Hinds specifications.



would your customer turn down a savings of $4,000 on a $40,000 lighting expenditure?

Your customers can enjoy the benefits of the *finest* lighting money can buy and effect really substantial savings at the same time, simply by buying the *right* lighting fixture. Time and again, the better design and efficiency of Smithcraft Fluorescent Fixtures result in *fewer units* to produce recommended lighting levels.

Here's an actual case history of how a Pennsylvania department store saved 10% in initial costs and 10% in operating costs . . . or approximately $4000 on a ten-year $40,000 expenditure.

Before re-lighting, a complete survey was made and exact lighting requirements were established. To meet these requirements, Smithcraft units and units of several nationally-known top quality manufacturers were subjected to an exhaustive *comparative* analysis. Here are the results:

10% *FEWER UNITS REQUIRED*

Number of units required to achieve recommended lighting levels: ..... Smithcraft — **270**
2nd Best Fixture — 297
3rd Best Fixture — 339

10% *LESS INSTALLATION COST*

Proportionately less labor and materials were required to install the 270 Smithcraft units than the 297 units of the nearest competitor.

10% *FEWER LAMPS*

(Initial & Replacement)

Lamps required: ..... Smithcraft — **706**
2nd Best Fixture — 776
3rd Best Fixture — 914

Recommended practice is to replace lamps every 18 months—a continuing 10% savings.

10% *LESS POWER CONSUMPTION*

Required wattage: ..... Smithcraft: **51.3** kilowatts
2nd Best Fixture: 56.3 kilowatts
3rd Best Fixture: 64.8 kilowatts

Whether you're lighting a store, office, school, factory, or institution, it pays to *buy lighting — not fixtures.* Invest in Smithcraft — America's Finest Fluorescent Lighting Equipment.

PHOTOGRAPH SHOWS AN INTERESTING PATTERN ARRANGEMENT OF THE SMITHCRAFT LOUVERLITE SLIMLINE IN THE PENNA. DEPT. STORE DESCRIBED ABOVE.

Tunnel Features Top-Flight Lighting

In San Francisco's 1616-foot Broadway Tunnel beneath Russian Hill, a single line of 2- and 3-lamp fixtures provides up to 26.4 footcandles of illumination to the roadway of each 2-lane tube, while supplementary lighting is installed at each entrance to minimize usually-existent high contrasts between sunlit exterior approaches and artificially-illuminated bore interiors. The installation also incorporates excellent overall design, harmonious color selection of lamps and tiling, automatic controls for lighting circuits and a high level of visual comfort for motorists entering or leaving the tunnel during hours of either daylight or darkness. These features have won national recognition for lighting consultants Humber & Walker, electrical contractor George F. Brayer, and San Francisco's chief electrical engineer, Ivan Sandberg.

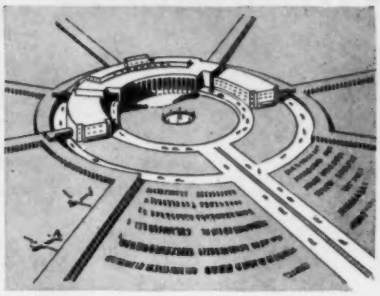
Although all tunnel approaches are on a slight 3% upgrade, motorists approaching the tunnel are not subjected to extreme sky glare since the height of the hill above the portals is considerable and overpasses adjacent to the portals serve as giant louvers in reducing overhead brightness. On leaving the tunnel, motorists are again protected against high sky brightness by the overpasses and the slight down-grade.

Used to illuminate the interior of the tunnels are a total of 503 Sunbeam fixtures containing T8 slimline 6-ft 3500° white lamps. Fixtures are also

CONTINUOUS ROW of 2- and 3-lamp fixtures, equipped with plastic enclosures and gasketed to exclude moisture, is mounted over the centerline of each 2-lane tube. With lamps operating variously at 120, 200 and 430 ma, intensities on the roadway range from a daytime high of 26.5 fc to a night-time uniformity of 13.4 fc. Yellow tiling of walls has a reflectance factor of 60% below the 8-ft level and 75% from that point to the 22-ft crown.

*Lighting that makes the nation's most important buildings come alive

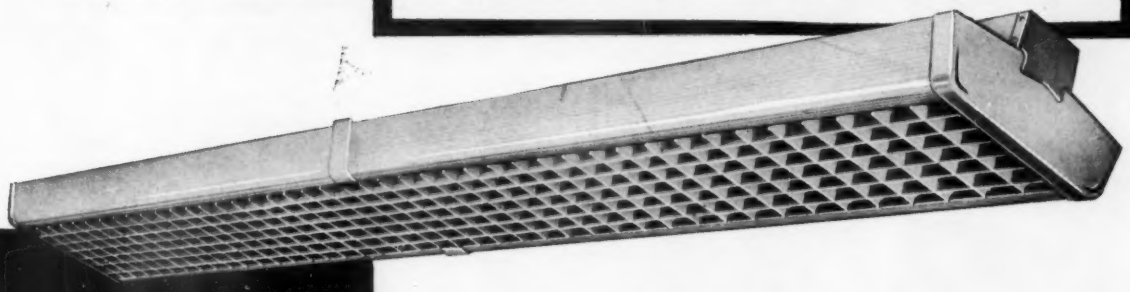
EMPIRE STATE BUILDING, N. Y. C.



IDLEWILD INTERNATIONAL AIRPORT, NEW YORK

CONSOLIDATED EDISON CO., N. Y. C.

DETROIT INSURANCE AGENCY, DETROIT, MICH.



SOME OF THE IMPORTANT ORGANIZATIONS NOW USING PHILITE SERIES 1118 or SERIES 1119 LUMINAIRES.

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Committee for Free Europe
Continental Casualty Co.
City Hall Annex, Philadelphia
Loft Candy Shops
Mepham Junior High Schools
National Banks of Detroit
New England Telephone Co.
Norden Instrument Co.
Speed Products Corp.

When fine lighting is required for either original installations or for modernization programs, more often than not the nation's leading organizations select Ruby-Philite luminaires. And for good reason. Ruby-Philite luminaires are designed to provide high levels of illumination with maximum efficiency and comfort, engineered for lowest installation and maintenance costs, and constructed to withstand hard usage. **Write today for complete catalog data.**

*PHILITE SERIES 1118 & PHILITE SERIES 1119 • Commercial luminaires with illuminated metal or translucent plastic sides available with choice of metal louver, plastic louver, or extruded plastic shielding.

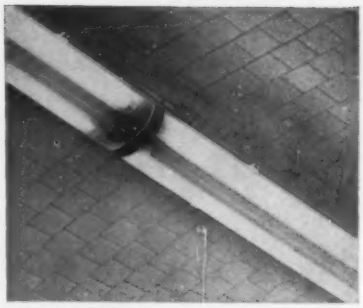
see our catalog in SWEET'S LIGHT CONSTRUCTION FILE or write for copy

PHILITE

MEMBER N.E.M.A.

Ruby-Philite Corp.

32-02 QUEENS BLVD., LONG ISLAND CITY 1, N. Y.



LUMINARIES are bolted to continuous wireways which, in turn, are secured to channels which were incorporated in the concrete shells of the tubes at the time of pouring. Access to wireways for inspection or maintenance is possible by removing the side panels. Lamps are 3500° white 6-ft T8s, with the center lamp in each 3-lamp fixture taken out of service at sundown through the automatic operation of an astronomical clock.

equipped with series-type ballasts and with acrylic plastic enclosures which are gasketed and provided with compressible seals between units in order to exclude detergents and water sprayed by maintenance trucks.

Within each of the 2-lane 1-way tubes, illumination is at three levels during daylight hours: the entrance sections having intensities of 26.4-fc at the center lines and 21.3-fc levels at curb lines; the center sections of the tunnel having intensities of 22.2 and 17.5 fc at the same two positions, and the exit sections having levels of 13.4 and 10.1 fc. To provide these levels, luminaires in entrance sections have two lamps operating at 120 ma and a third one operating at 430 ma; center sections have two lamps at 120 and one lamp at 200 ma, while exit sections are equipped with luminaires containing only two lamps, both operating at the basic level of 120 ma.

In addition to this artificial illumination within the tunnel, each entrance is surmounted by a 40-ft glass block skylight to lessen the sudden drop in exterior lighting levels.

As darkness approaches and sky brightness diminishes, these lighting values in the tunnel are automatically reduced through the action of an astronomical clock. At that time the third lamp in each 3-lamp fixture is taken out of service, thereby dropping the center-line intensities to a constant 13.4-fc throughout each tube.

Throughout the entire length of the tunnel, lighting fixtures are bolted to wiring raceways which, in turn, are bolted to continuous hanger channels which were incorporated in the concrete shell of the tunnel during the original pouring stages. For inspection, wiring is accessible by removing side panels from the raceway system.

Famous POWERSTAT Dimming Equipment

Now Renamed

LUXTROL

Light Control Equipment

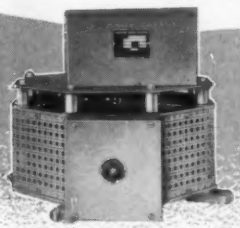
Cool operating, flickerless performance . . . to match every need . . . every budget

It's the same well known line of Superior Electric's transformer-type light control equipment. Just a new name: LUXTROL. From light . . . to dim . . . to dark, these light controllers do *not* dissipate wasteful heat . . . *do* provide cool, smooth, flickerless performance. LUXTROL light control equipment meets all operating and budget requirements of small or large installations in theatres, auditoriums, churches, schools, night clubs, stores.

PACKAGED LUXTROL LIGHT CONTROL EQUIPMENT

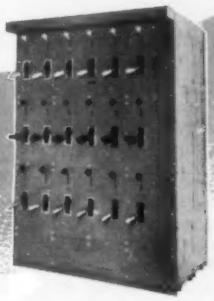
Provides big switchboard blending and control at low cost. Additional units can be added as need and budget increases.

See the Superior Electric's Mobile Display when it visits your area.



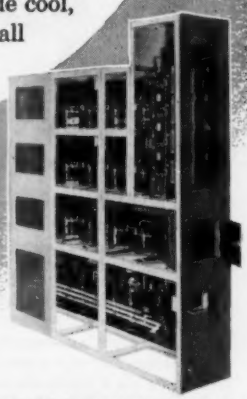
NON-INTERLOCKING LUXTROL LIGHT CONTROL EQUIPMENT

Ideal for auditorium or single room lights where only a few circuits require control. Manually operated or motor driven assemblies. Capacities from 1,000 to 30,000 watts.



INTERLOCKING LUXTROL LIGHT CONTROL EQUIPMENT

Single units or assemblies for mounting in factory framed assemblies. With or without mastering or grand mastering controls. Can be engineered to meet all power control requirements.



THE POSITIONER SYSTEM OF LUXTROL LIGHT CONTROL EQUIPMENT

Motor-driven LUXTROL control assemblies remotely-controlled from compact selector stations located at point of greatest convenience or from portable box.

THE SUPERIOR ELECTRIC COMPANY

6114 Demers Avenue, Bristol, Connecticut

Manufacturers of: POWERSTAT Variable Transformers • STABILINE Automatic Voltage Regulators • VOLTBOX A-C Power Supplies LUXTROL light control equipment • VARICELL D-C Power Supplies Superior 5-WAY Binding Posts

THE SUPERIOR ELECTRIC COMPANY, 6114 Demers Ave., Bristol, Conn.

Please send full information about LUXTROL light control equipment:

☐ Packaged Assemblies ☐ Interlocking Types
☐ Non-Interlocking Types ☐ The Positioner System

Name.....

Company Name.....

Company Address.....

City.....Zone.....State.....

RECOMMENDED WHERE:

1. Seeing tasks demand 25 footcandles or more.
2. Walls, ceilings, machinery, etc., have good reflectance.
3. You need *super-comfortable* illumination.
4. Maintenance costs are important.
5. *Best* lighting is required at *reasonable* cost.

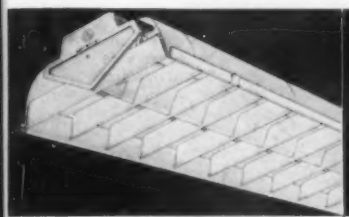
THE REVOLUTIONARY NEW LIFETIME

CFI-25

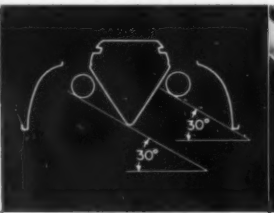
WITH 25% UPWARD COMPONENT

The CFI-25 is more than a new fixture. It is the beginning of a new era of super-comfortable industrial lighting. For the first time, the CFI-25 makes available a rugged, premium quality industrial fixture with all the comfort advantages of 25% uplighting—*within a practical price range!*

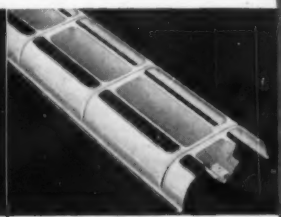
See this sensational new development. Compare it—feature for feature—with any other industrial fixture on the market. Notice the full 8-foot, one-piece, porcelain enameled reflectors . . . the new "bridge-type" ribbed construction . . . super-comfortable shielding . . . the many, many features that make the CFI-25 the most modern product in its field. Available for 8 ft. Slimline, 4 ft. Rapid Start and the newly developed 8 ft. High-Output Rapid Start lamps.



20° LENGTHWISE SHIELDING. Optional louver assembly provides excellent visual comfort. Louvers furnished in 4-ft. sections, hinge either side for easy servicing.



30° CROSSWISE SHIELDING. Porcelain reflector provides comfortable 30° crosswise shielding, adds substantial strength and rigidity to the fixture.



NEW RIBBED CONSTRUCTION. Reflectors reinforced by die-embossed ribs between apertures. Ribs add lateral stability, prevent spreading, maintain straight fixture edges.

IMPORTANT!

Here's why *only*

PORCELAIN ENAMEL

is used for CFI reflectors!

An industrial lighting fixture is no better than the wearing qualities of its reflecting surfaces. The lasting qualities of baked enamel reflectors are questionable in industrial applications. *Only porcelain enamel guarantees a lifetime of service at the least cost.*

Porcelain enamel does not decay or change with age because it is *inorganic*—nothing but rock-like minerals that are actually melted and fused to the base metal under extremely high temperature (1400-1600°). The result is a

CFI MEANS COMFORT FOR

CALL OR WRITE YOUR NEAREST DAY-BRITE REPRESENTATIVE FOR THE

THE NEW DAY-BRITE LIFETIME INDUSTRIAL SERIES— ONLY INDUSTRIALS WITH FULL 8-FOOT, ONE-PIECE, PORCELAIN ENAMELED REFLECTORS

THE LIFETIME

CFI-10

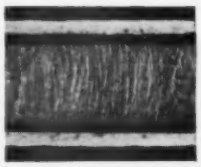
WITH 10% UPWARD COMPONENT

Sets a new high standard for industrial lighting fixtures! 10% uplighting reduces glare and lessens brightness contrasts. Full 8-foot, one-piece, porcelain enameled reflectors featuring new super-rigid ribbed construction. Runs line up perfectly, *stay perfect.* Available for 8 ft. Slimline, 4 ft. Rapid Start and the newly developed 8 ft. High-Output Rapid Start lamps. Engineered and built to give a *lifetime of service.*

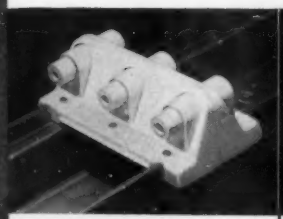
flint-hard, indestructible bond of metal and finish that is unaffected by time, heat, moisture and other harmful elements.

No baked enamel finish can assure you the non-yellowing, noncorrosive reflection surface that porcelain enamel does. There are no tiny surface pores in porcelain enamel. Any dirt or stain is external and is easily wiped away.

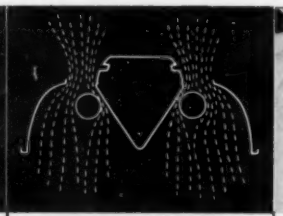
Because of its undisputed superiority, specially formulated porcelain enamel with a reflector factor of 85% or more is the one and only finish Day-Brite uses on the reflection surfaces of the CFI-25 and the CFI-10 ... to make them in fact — as well as in name — a *Lifetime* industrial lighting value.



Microphoto shows how metal and porcelain enamel fuse together to form lifetime bond.



SPRING-LOADED SOCKETS. Firm lamp contact, firm seating. Metal clad for positive alignment and protection against breakage. Individually replaceable.



COOLER, CLEANER OPERATION. Diagram demonstrates "up-draft" action through apertures. Constant flow of air keeps dust from settling, reduces operating temperature.

FAST, SIMPLE MAINTENANCE. Reflectors on or off in seconds, fasten to channel by hand-operated 2" wing-nuts. Porcelain enamel wipes clean quickly, is noncorrosive.

INDUSTRY!

COMPLETE QUALITY STORY

"DECIDEDLY BETTER"
DAY-BRITE
Lighting Fixtures

Day-Brite Lighting, Inc., 5402 Bulwer Ave., St. Louis 7, Mo. In Canada: Amalgamated Electric Corp., Ltd., Toronto 6, Ontario.

4107

Another reason why...

NEW G-E WHITE CONDUIT IS EASIER TO HANDLE

Electrical contractors are applauding another important quality that makes the new G-E WHITE rigid steel conduit faster to install—the ease with which it can be threaded. The metallizing process used to apply the zinc coating to G-E WHITE produces a unique structure which acts as an ideal cutting lubricant. This process also assures easier bending and outstanding corrosion protection.

G-E White is lined with a new corrosion-resistant coating, containing a special antifriction agent that lets wires slide freely and cuts fishing and wire-pulling time. It's listed by Underwriters' Laboratories, Inc., and meets all Federal Specifications. To simplify conduit installations and guard against corrosion, ask your distributor about the new G-E White rigid steel conduit, or write Section C43-1118, Construction Materials Division, General Electric Company, Bridgeport 2, Connecticut.

Progress Is Our Most Important Product

REWIRE AMERICA ... WITH GENERAL ELECTRIC WIRING SYSTEMS

GENERAL ELECTRIC

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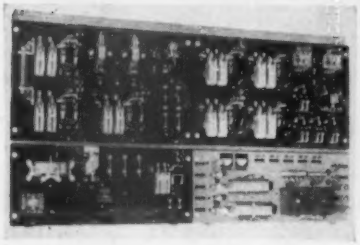
IMPORTANT...

- PLEASE PRINT LEGIBLY
- USE BLACK OR DARK BLUE INK
- DO NOT USE PENCIL OR RUBBER STAMP

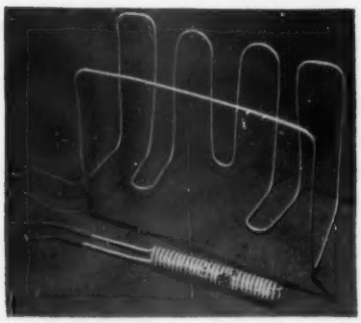
Product News



Hoist Control (1)

New Bulletin 14166 ac hoist controller for use with wound rotor motors combines the characteristics of the eddy-current load brake and the regulating amplifier to obtain speed-torque curves previously unavailable on ac hoists. The excitation of the eddy-current load brake is provided by the magnetic amplifier whose output in turn is dependent upon the balance between the field strengths of the amplifier's reference field as established by the position of the hoist master switch, and the amplifier's signal field as established by the actual speed of the hoisting motor. The regulating action thus provided by the magnetic amplifier affords a set of specific lowering speeds virtually unaffected by changes in the hook load. In addition to regulating lowering speeds the eddy-current crane brake also aids the hoist's magnetic holding brake in decelerating the load each time the hoist is stopped. Automatic eddy-current brake failure protection is also provided. Lowering speeds are easily adjustable by means of slide wire rheostats on the control panel. Publication EC-165 is available.

Cutler-Hammer, Inc., 228 N. 12th St., Milwaukee 1, Wis.



Heating Units (2)

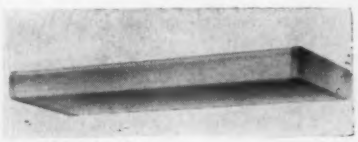
Corox heating units are now available in continuous lengths up to 25 feet with an outside diameter as small as .230 inch. Heaters can be formed into shapes and sizes to heat almost any surface or enclosure. Use of single, low-watt density heaters in lengths as long as 25 feet eliminates the "sets" of two or more heaters. Neoprene-covered lead wires are attached to heater terminals and sealed under pressure. Heaters are made in copper, steel, aluminum, Incaloy, Inconel and other alloy tubings.

Westinghouse Electric Corp., Pittsburgh 30, Pa.

Mercury Switch (3)

A new mercury switch with a lighted handle. A tiny neon light in the handle of switch glows when switch is in off position, making it ideal for such locations as bathrooms, bedrooms, long hallways, entrance ways, nurseries, hospital rooms, and hotel rooms. It also can be used as a "reverse" pilot light for installation at head of basement stairs, foot of attic stairways, etc. In such locations, the lighted handle not only makes these switches easy to locate, but indicates that the light in basement or attic is turned off.

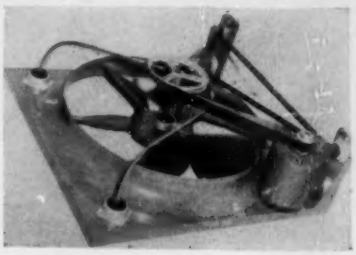
Construction Materials Division, General Electric Co., Bridgeport 2, Conn.



Lighting Fixtures (4)

A new group of fluorescent lighting fixtures for stores, known as Storelites. There are three types of fixtures and all are for use with only one type of fluorescent lamp, the Rapid-Start. The Merchant comes in 2- and 4-lamp, 48-in. size. Plastic side panels minimize side and bottom contrast. Choice of one-piece Diamond Lucite or one-piece injection molded plastic louver bottom enclosure. The Suburban has a full one-piece plastic body with aluminum ends. Comes in 2- and 4-lamp, 24- and 48-in. lengths. The Supermarket is a bare lamp type, in 2- and 4-lamp, 48- and 96-in. lengths. All models in this group are made for surface or suspension mounting, individually or end to end in continuous rows.

The Miller Company, Meriden, Conn.



Attic Fan (5)

A new fan for small ranch type homes, known as the McLean VT-20 vertical discharge attic fan. It is designed especially for the home having living space floor area of 1000 sq. ft. or less and having ceiling joists on 24-in. centers. The VT-20 fan and the 20-in. by 27-in. ceiling shutters can be installed in these homes without cutting a ceiling joist. Each fan features rubber mounted main bearing and motor; flexible steel frame; soft rubber, built-in, vibration absorbers; Torrington fan blades; long hour duty motors with sleeve bearings for quiet operation and automatic thermal overload protection.

McLean Engineering Laboratories, P. O. Box 531, Princeton, N. J.

Wiring Devices (6)

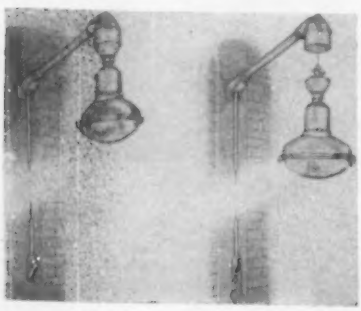
A new series of spring-type screwless terminal switches and receptacles, known as Quickwire. They incorporate a heavy coil spring connector which holds the wire in place. The spring pressure connectors assures permanent contact. Wires can be released by the insertion of a screwdriver into the release hole. Devices are designed to facilitate installation. Other features are deeply recessed wire wells that prevent exposure of bare wire, fully enclosed housing, plaster ears and handy strip gauge marking on each device. Receptacles are available in either brown or ivory. Switches have brown or ivory toggles.

Leviton Manufacturing Co., Inc., 236 Greenpoint Ave., Brooklyn 22, N. Y.

Lighting System (7)

A new system of wall-to-wall lighting, known as the Sylvan-Aire, incorporates both light and sound control. The system provides architectural beauty by means of a continuous wall-to-wall corrugated white plastic ceiling, which also is the source of soft, cover-all lighting. Through the use of spaced V-shaped "Sono-Wedges" lined with thick glass-fiber pads, noise is deadened and disturbing sounds are reduced to comfortable levels. Fixtures are concealed and can be mounted where most convenient. Two basic mounting systems comprise the Sylvan-Aire method of area lighting. In the Uni-spaced suspension system, fixtures are installed on 3-ft centers to conform with the location of plastic supports channels. With the Vari-spaced suspension system, the number and spacing of fixtures may be varied in accordance with the desired level of illumination. The flexibility of the Sylvan-Aire system permits the use of the sound control Sono-Wedges as optional equipment. They may be added at a later date to a system already installed.

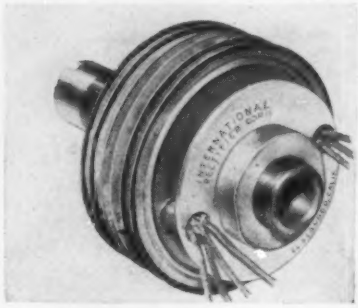
Sylvania Electric Products, Inc., Salem, Mass.



Brackets (8)

"Servisafe" wall and wood pole brackets are designed to permit safe ground-level luminaire servicing. Incorporating the patented Thompson disconnecting and lowering hanger mechanism, these units eliminate climbing and electrical hazards. To lower a luminaire mounted on a bracket, workmen opens tamper-proof lockbox mounted near wall or pole base and attaches a separate handline to operating cable. He then disconnects the two hanger members with a slow pull and quick release on handline and lowers lighting fixture to ground-level. Because live contacts remain in fixed-position upper member, lowered luminaire is "dead". After fixture is serviced, it is returned to operating position and automatically re-seated by means of handline. Units can be used with standard pendant and flood type luminaires. Mast arms ranging from 2 to 12 feet, in 2-ft increments, are available. Bulletin No. WPH-54 is available.

Thompson Electric Co., 1157 Power Ave., Cleveland 14, Ohio.



Selenium Rectifier (9)

A new rotating selenium rectifier which eliminates dc exciter and associated commutator troubles. The basic principle of applying a rotating rectifier is to mount the unit on the same shaft with the alternator field and ac exciter. Exciter field is fed from an external dc supply, which may be another rectifier and a variable transformer. Output from the exciter, usually 3-phase, is fed into the ac terminals of the rectifier. Output from the rectifier is connected directly to the alternator field windings. Using an ac exciter eliminates the commutator and since the rotating rectifier is on the same shaft with the alternator field, the usual slip rings are not required. The rotating rectifier illustrated uses six individual 5-in. diameter selenium plates. It is used to supply power to the field of a 30-kw diesel generator set, and will deliver 750 watts at 30 volts.

International Rectifier Corp., 1521 E. Grand Ave., El Segundo, Calif.

Starter (10)

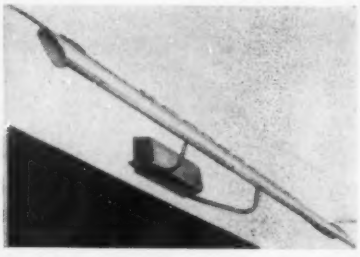
A new starter designed to give longer average life to regular 40-watt fluorescent lamps. Starter contains a glow switch which prevents the voltage surges which are sufficient to cause instant starting of lead-circuit lamps thus shortening lamp life. The new switch assures proper preheating time for lead-circuit lamps and prolongs lamp life. The flow switch starter for 40-watt lamps has been designated as the FS-400 Watch Dog starter.

Construction Materials Division, General Electric Co., Bridgeport 2, Conn.

Conduit Fitting (11)

A new series of conduit fitting Pylets designated the "OR" series. These are designed with many interchangeable features to meet all electrical conduit fitting requirements for machinery wiring as well as plant maintenance and new construction. The ferrous alloy castings have tapered machine-cut threads. Large flat-back area is drilled for secure mounting on vibrating machines and other areas. Interiors are roomy and smooth to facilitate wire pulling and rounded edges prevent wire damage. Oval covers have self-retaining screws.

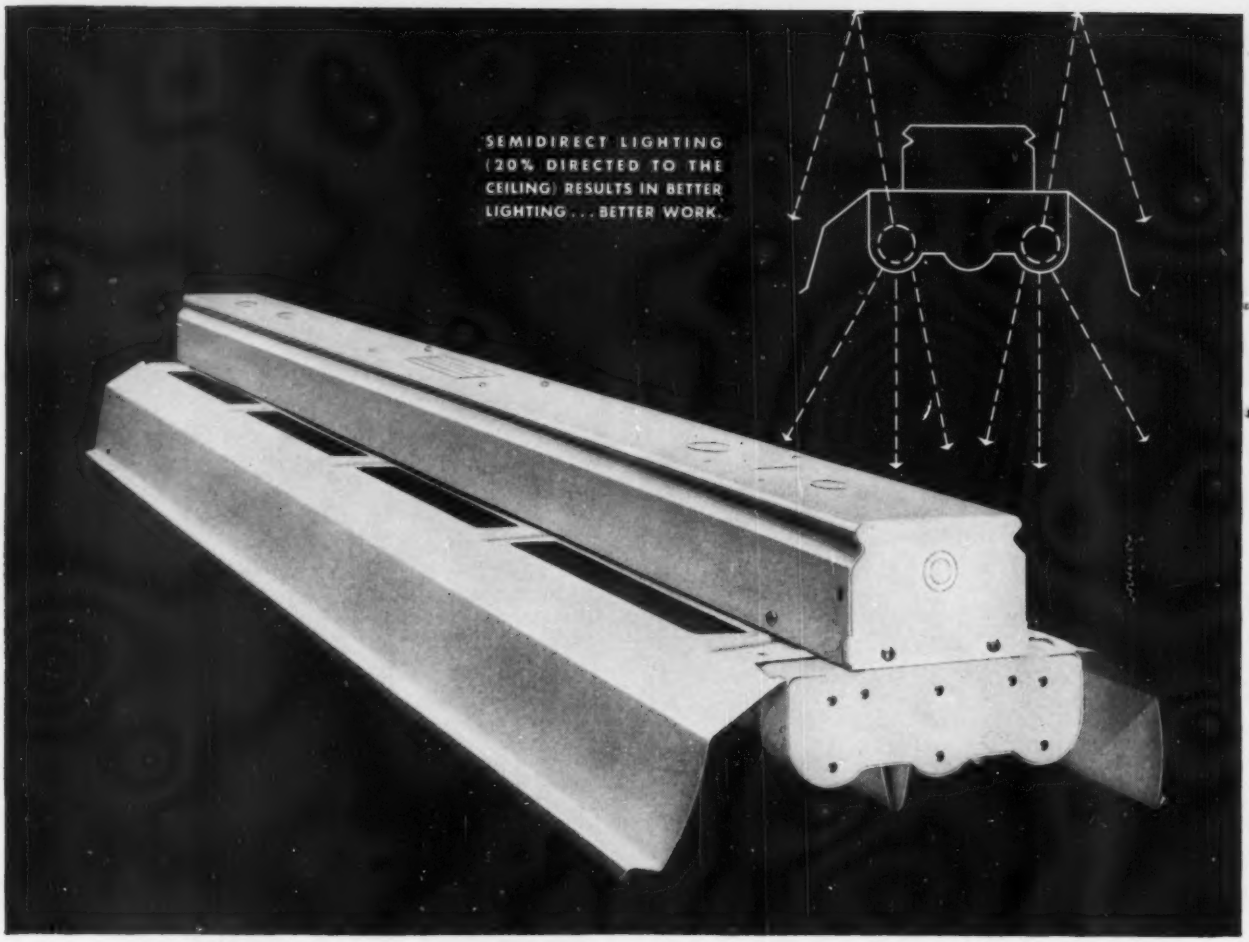
Pyle-National Company, 1334 North Kostner Ave., Chicago 51, Ill.



Lighting Fixture (12)

The Chalkboarder is a new fluorescent lighting fixture designed for the supplementary lighting of vertical surfaces. It provides vertical lighting of chalkboards in classrooms, in libraries, art galleries, and similar installations. It is also effective when used with displays, exhibits and bulletin boards, and can be utilized for cornices, indirect lighting and wall desk lighting. Designed for rapid-start bi-pin and slimline lamps, unit can be installed and adapted to meet specific lighting requirements. Reflector may be rotated for proper shielding, and apertures in top of reflector permit a soft uplighting to reduce contrast between unit and lighted area below. It is finished in gray Neutratone. Reflector is aluminum with inner reflecting surface finished in white supercoat baked enamel. Available in 4-ft. 8-ft. and 16-ft. units for individual or continuous mounting.

Smithcraft Lighting Division, Chelsea 50, Mass.



New RLM heavy-duty luminaires assure greater lighting economy

Designed for semi-direct lighting, the new RLM with slotted reflector provides 20% upward component lighting—releasing light that was formerly trapped in this area. And light-colored ceilings now become part of the lighting system—assuring highest illumination levels with better distribution, brightness control and shielding.

But the real lighting economy test is the time and money spent for installation . . . and in operating and maintaining the system at peak efficiency. Luminaire design makes the difference. For instance, with the new Westinghouse RLM heavy-duty luminaire:

Lightweight, completely wired channels mean fast installation. "V" grooves for adjustable slide hangers give flexibility of mounting.

Bonderized channels protect and preserve finishes.

Heavy-duty, steel-enclosed lamp holders eliminate breakage; and spring-loaded sockets make lamp replacement easy.

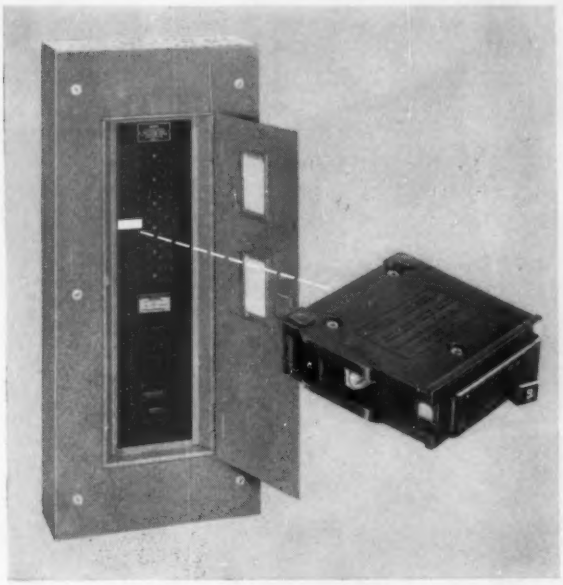
Large, easy-to-grip wing locks simplify maintenance by making reflector removal easier.

ETL approved ballasts assure maximum life and minimum maintenance.

To get the full story on this new Westinghouse RLM line, have your Westinghouse distributor bring you booklet B-5644. DP-5008-B

YOU CAN BE SURE...IF IT'S

New circuit breaker panelboard gives new low-cost protection



It's the new Westinghouse Type NPLB plug-in panelboard for lighting circuits. And it provides maximum protection at a new low cost through a new AB circuit breaker.

This compact panelboard is of the same quality construction as the well-known Type NPLAB. It, too, features snap-on covers over neutral bar and main lugs, special circuit breaker wiring terminals, permanently visible branch circuit and phase identification.

The new circuit breaker features a quick-make, quick-break mechanism and provides "ON", "OFF" and "TRIP" positions in the operating handle. Mounting arrangements and dimensions are identical to the Quicklag®-P.

A call to your Westinghouse distributor will bring more facts.

New Type MB autostarter has three exclusive features

It brings these distinct and exclusive advantages to provide increased protection and greater savings in man-hours and production time:

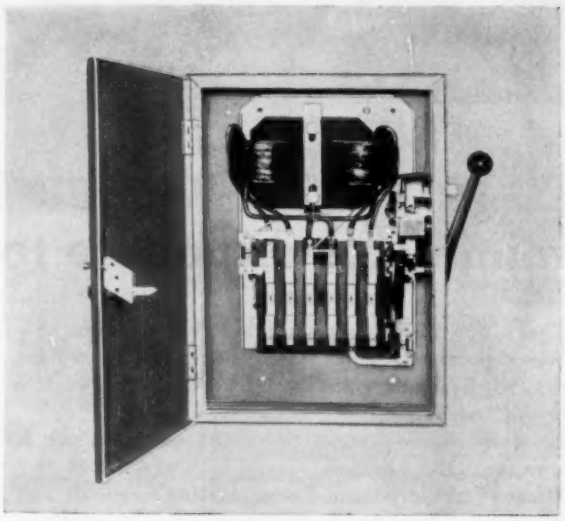
Air brake contacts which completely eliminate the need for oil or oil pans. Double contacts can now be used, slashing maintenance problems. Both features are available in all ratings, 600 volts and below.

A visual signal that indicates when the transfer can be made from "start" to "run" position, eliminating all guesswork in the starting operation.

Performance-proved Type MW overload relays, providing the finest in motor protection. A third MW relay may be added to provide maximum protection on all three phases.

The new autostarter applies wherever across-the-line starting current of squirrel-cage induction motors may exceed local power restrictions . . . or interferes with plant operations. Current inrush is kept within levels, yet maximum starting torque is assured.

DP-5008-C



Westinghouse

New heavy-duty safety switch minimizes exposure to live parts

That's one of the outstanding features of the new Westinghouse Type "H" safety switch—designed for rugged, heavy-duty industrial applications. Here's how it's attained:

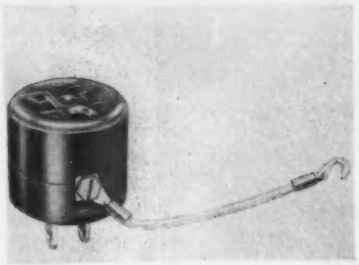
Interlocked cover—cannot be opened when the switch is in the "ON" position.

Micarta® shield—located over the line terminals and minimizing exposure to live parts when inspections or fuse replacements are made.

Also, the new Type "H" safety switch has a Neoprene gasket and trunk-type cover latches, making it a NEMA-1A dust-resisting enclosure. All copper parts are tin-plated. And the operating mechanism is contained in a rugged cast handle—leaving side gutters free for wiring.

Now available in a complete range (up to 1200 amps and 600 volts) from your Westinghouse distributor. Call him for the details. DP-5008-D

YOU CAN BE SURE...IF IT'S Westinghouse



Adapter (13)

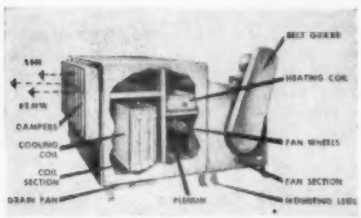
A new 3-wire composition grounding-type adapter designed to adapt standard 2-wire convenience outlets for use with 3-wire grounding caps. The adapter will withstand rough treatment without cracking, chipping or breaking. This is due to the rugged composition material used for the body. Other features include parallel polarized slots and "U" shaped grounding slot; parallel polarized blades, one narrow and one wide; hook-type terminal for connecting to ground; green 3-in. thermoplastic lead and double-side contacts. Designated No. 5273-L (with lead) and rated at 15 amps, 125 volts, the adapter meets UL specifications and is designed to ASA standards. Literature is available.

Harvey Hubbell, Inc., Bridgeport, Conn.

Wire Markers (14)

New all-temperature wire markers that withstand continuous heat to 300°F, intermittent heat to 450°F, and continuous cold to —300°F, indefinitely. For electrical construction work, markers provide economical methods for identifying wires and conduits. Markers are mounted on handy dispenser cards treated with No. RC-7 blue streak release coating. Markers are treated with silicone plastic overcoating, which protects them from dirt, dust, grease, moisture and abrasion. They are available in two sizes: 1½-in. long markers for wires over ¼-in. O. D., and ¾-in. for small gage wires. Bulletin No. 130-B is available.

W. H. Brady Co., 727 W. Glendale Ave., Milwaukee 12, Wis.



Air Conditioning Unit (15)

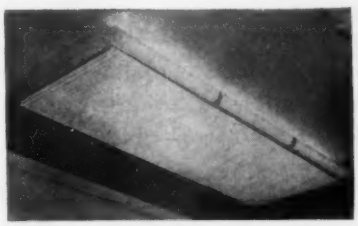
A new multi-zone air conditioning unit which can supply individual temperature and humidity requirements of as many as 12 zones in a building. The central plant unit maintains a comfortable temperature in various zones regardless of variations in building construction, changes in occupancy, wind or solar exposure. The unit forces air over either cooling or heating coils or a combination of the two according to demands of zones. Two non-overloading, backwardly-inclined blade fans operating in a pressure chamber constitute the fan assembly. Unit is available in seven sizes ranging from 1,665 to 21,000 cubic feet per minute. While designed primarily for office, commercial and public buildings, unit is equally applicable in large residences where individual zone control is required.

Westinghouse Electric Corp., Sturtevant Div., 200 Readville St., Hyde Park, Boston 30, Mass.

Transformer (16)

A new Class "B" transformer designed to permit a temperature rise as high as 80 degrees Centigrade. Because of its higher operating temperature, the Class "B" unit is lighter and smaller than a comparably rated transformer with Class "A" insulation which is designed for only a 55 degree Centigrade rise. For use on circuits of 600 volts or less. Integral wiring compartment for primary and secondary terminals eliminate necessity of additional wiring boxes.

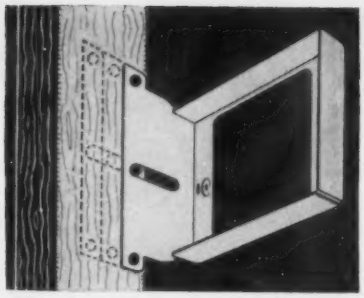
Dongan Electric Mfg. Co., 2987 Franklin, Detroit 7, Mich.



Lighting Fixtures (17)

The "Diamond Jubilee Series" of light fixtures are for use in offices, banks, schools, stores and corridors. The special unbreakable thin translucent corrugated "Lumi-Plastic" bottom and sides offer high light transmission with low surface brightness. All lamps and component parts are hidden from view. A special combination hinge and latch permits ease of cleaning and relamping by swinging down the "Lumi-Plastic" diffuser frame leaving both hands free to use. Fixture is now available in three widths—16, 28 and 40 inches. The respective fixtures use 2, 4 and 6 lamps. Lengths of fixtures are 96⅛, 72⅛ and 48⅛ inches. Depth of all fixtures is 6¾ inches. Units may be used individually or in continuous rows.

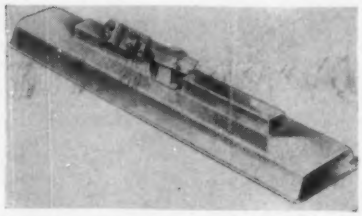
Luminous Ceilings, Inc., 2500 W. North Ave., Chicago, Ill.



Switch Support (18)

A new switch support, designed specifically for low-voltage remote-control flush switches and remote-control master selector switches. Support can be used on dry-wall, plaster wall, or heavy wall (⅜-in., ⅝-in. and 1-in. construction). It will take one, two, or three remote-control switches or one master selector switch. Three nail holes provide easy, rigid mounting, and recessed holes allow tight seating of switch mounting strap screws.

Construction Materials Division, General Electric Co., Bridgeport 2, Conn.



Fluorescent Floodlight (19)

A new high-pole-mounted fluorescent floodlight for service station lighting. The new 9000 Series luminaire projects a broad long-throw beam of white glareless light over driveways, ramps and approaches. Unit is designed for use on existing poles. Watertight housing is of welded, die-formed aluminum, while frames using either Plexiglas or Alba-Lite glass are of extruded aluminum. Specular reflector is formed from Alzak aluminum sheet. Pole-fitting mounting arm is adjustable from horizontal to 10, 20, 30 or 45 degrees. Unit measures 72-in. by 16½-in. by 8⅜-in. and is wired ready for connection in the field. It uses four 100-watt cool white, rapid-start fluorescent lamps.

Guardian Light Company, 500 North Blvd., Oak Park, Ill.

Air-Break Starters (20)

A new line of air-break starters for 200-5000-volt squirrel-cage, wound-rotor and synchronous motors. Starters are built in three styles: 500,000 kva interrupting capacity; with power fuses for systems of 150,000 kva (2300-volt) and 250,000 kva (4600) availability; and in the Valimitor (volt-ampere-limitor) style in which air-core reactors limit infinite kva to a finite value within the rating of

the starter. Type ZHA air-break contactor, has an interrupting capacity of 50,000 kva. Incorporated in the complete starter are safety door-switch on disconnect-switch compartment, swinging overload panel, self contained bus for group installation, meters are required and cabinet-doors which may be lifted off concealed-type hinges during installation. Contactor is accessible from front and rear of cabinet. For reversing service, forward and reverse contactors are mechanically as well as electrically interlocked.

Electric Controller & Mfg. Co., 2700 East 79th St., Cleveland 4, Ohio.

Control (21)

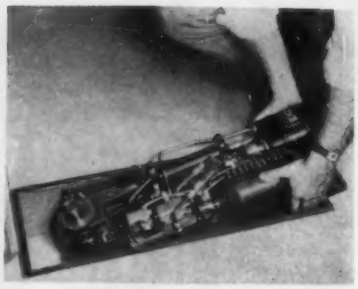
Model 292 Series Capacitrol has been designed for accurate indicating and instantaneous control in the process industries. This easy to service instrument uses plug-in components. Both temperature measuring system and control chassis are of plug-in design. Model 292 Series provides for flexible "on the job" adjustments. The balancing adjustment for tuning the alignment index and indicating pointer to exact coincidence, plus adjustment of anticipatory action cycle time, along with control setting are all front accessible. Bulletin F 5358-1 is available.

Wheelco Instruments Division, Barber-Colman Co., Rockford, Ill.

Hydraulic Switch (22)

Hydratube is a hydraulically operated electrical switch self-contained in a ½-in. diameter flexible plastic tube. Flexibility of plastic tube allows it to be bent in excess of 90° without impairing operation of switch. Adjustment can be made so that pressure as low as 1 oz. will actuate switch, when installed on a horizontal plane. Capacity of palladium contacts is approximately 1-amp when switch is adjusted to require 6 to 8 oz. pressure. Hydratube is available in standard lengths of 6 ft. and 12 ft. Lengths up to 300 ft can be made to order. Hydraulic fluid is permanently sealed in plastic tube. A special rubber extrusion is available for mounting, and is designed to be mounted on flat, round or uneven surfaces. It can be used anywhere an extended length sensitive switch is required for automatic or manual control.

Recora Company, 56 West 103d St., Chicago 28, Ill.



Door Opener (23)

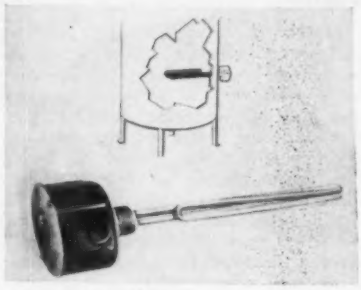
A new all-in-one package electro-hydraulic door operator called the Supermatic. It is for installation on all swing-type doors weighing up to 350 pounds, and provides completely automatic door control for stores, supermarkets, banks, hotels, restaurants, showrooms—all commercial buildings and institutions. Door operators are instantly activated by pressure on a treadle or by breaking an electric eye beam. Each operator is a package, 29-in. long by 11-in. wide by 6½-in. deep, and is a universal unit for either left or right hand door operation. Unit is installed out of sight under the door's threshold, sealed weathertight, and will function at all temperatures from minus 40° to plus 200°F. The treadle, which electrically activates the operator, lies flat and divided by the door. Control box houses an adjustable timer to hold the door open for the desired length of time, and a switch for "automatic", "manual" or "full open" position. This box may be mounted anywhere and wired to the operator through a conduit.

National Pneumatic Co., Inc., Boston 19, *Mass.*

Home Fire Alarm (24)

This new home fire alarm is designed to provide immediate warning of fire to the householder through a detector device with a bell signal. The alarm is packaged with complete instructions for installation. It includes a signal unit with a highly audible, distinctive sounding bell, a bell-ringing transformer, and a test button, fully enclosed in a 2-in. deep box. Metal box is covered by an aluminum plate, approximately 6 inches by 5 inches, equipped with cord and plug, for mounting on the wall. Two thermal detector units are supplied as standard equipment. It is recommended that the signal unit of the alarm be mounted in master bedrooms or hallways in the sleeping area of homes. Unit does not require adjustment or servicing, and may be checked at any time by pressing the test button, or holding a lighted match directly under a detector. The alarm is set for release whenever temperatures reach 140°F within the 400 square foot area covered by each detector. Except for a 115-volt supply to transformer, the system operates on a 10-volt "bell transformer" current.

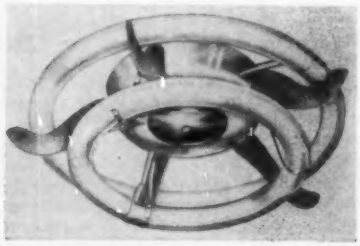
Edwards Company, Norwalk, Conn.



Immersion Heater (25)

Thermostatic control and the Corox element have been combined in a one-piece immersion heater. It is designed to convert any domestic water tank up to 100 gallons capacity to automatic electric heating. Thermostat may be adjusted to maintain constant water temperatures in a range from 120 to 180 degrees F. Unit is available in power ratings from 750 to 2500 watts for either 118-volt or 236-volt applications. Heaters are applicable to laundry equipment, steam tanks, laboratory equipment and dairy equipment.

Westinghouse Electric Corp., Pittsburgh 30, *Pa.*



Lighting Fixture (26)

A new circline lighting fixture, called the "Saturn". It combines the new 40-watt circline lamp with the standard 32-watt lamp. Perforated steel louvers are utilized not only as lamp supports, but also as an effective means of obtaining a low brightness effect. Unit is available in white baked enamel with chrome center ornament, or in all-chrome, and the louvers are finished in aluminum gray. Instant-lighting ballasts are incorporated.

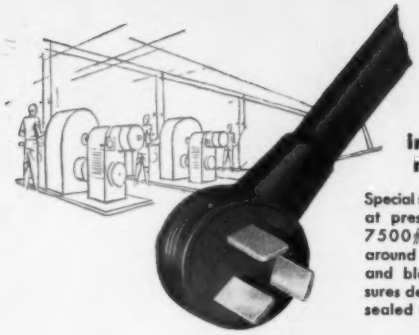
Carter Lighting Co., Chelsea 50, *Mass.*

THERE IS A "RIGHT" CORD

For Ranges and Dryers

It's a PARANITE® "SAFE" cord

and here's why

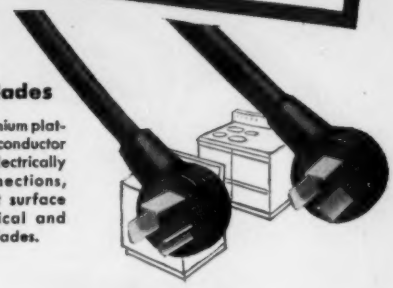


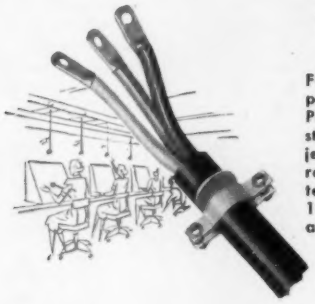
injection molded

Special rubber compound, at pressures exceeding 7500# p.s.i. forced around jacket, insulation and blade junctions insures dense permanently sealed rubber cap.

plated blades

Complete Cadmium plating, from tip to conductor crimp, assures electrically superior connections, better contact surface within receptical and clean bright blades.





100% "cords" control

From rubber, compounded specially at the Paranite Mill, through stranding, insulating, injection molding, strain-reliefs, terminals, and tests, these cords are 100% inspected and UL approved.

electrically superior

Insulation Resistance between conductors exceeds 32,500 meg-ohms. (50 meg-ohms standard). Dense molded cap insures exceedingly high dielectric strength properties.

It takes specially compounded rubber, precisely controlled equipment and close supervision to injection mold these 90° angle caps . . . but look at the results! You get a firm, dense and more uniform permanently molded cap that means complete customer satisfaction.

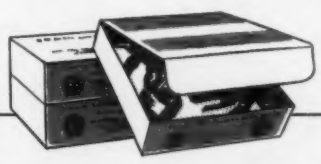
Cadmium plating of blades is another important "extra" you get with all PARANITE Range, Dryer and Appliance Cords . . . which assures a more dependable and surer electrical contact.

PARANITE Cords give outstanding performance . . . Insulation Resistance of over 32,500 meg-ohms and extremely high dielectric qualities prove their superiority.

To perfect, manufacture and 100%-inspect cords of this calibre takes extra effort . . . but PARANITE "Safe" Cords have a reputation to maintain and *they must be* RIGHT!

RANGE CORDS
RP-1 2 #8—1 #10
RP-2 2 #6—1 #8
RP-3 3 #6

DRYER CORDS
RP-10-PG 3 #10



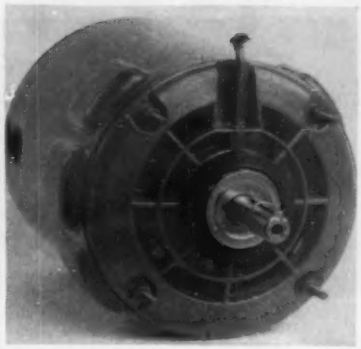
separately packed in sturdy cartons

If it's PARANITE it's right

PARANITE WIRE & CABLE DIVISION • ESSEX WIRE CORPORATION
FORT WAYNE 6, INDIANA

MANUFACTURING PLANTS: Birmingham, Alabama; Anaheim, California; Jonesboro, Indiana; Marion, Indiana.

WAREHOUSES* AND SALES OFFICES
* Atlanta, Georgia, 241 Boulevard, N. E.
Boston, Mass., 1040 Tremont Street
* Chicago, Illinois, 411 South Peoria Street
Cleveland, Ohio, 1900 Euclid Avenue
Dallas, Texas, 1917 Levee St.
* Detroit, Michigan, 634 Selden Avenue
Hartford, Connecticut, 119 Ann Street
Indianapolis, Indiana, 5219 Crittenden Avenue
* Kansas City, Missouri, 2000 Forest Avenue
* Los Angeles, California, 2240 East Washington Blvd.
Minneapolis, Minnesota, 5407 Excelsior Boulevard
* Newark, New Jersey, 457 Frelinghuysen Avenue
Omaha, Nebraska, 320 W. O. W. Building
* Portland, Oregon, 525 North Tillamook St.
Upper Darby (Philadelphia) Pa., 6816 Market Street
Rochester, New York, 207 Powers Building
* San Diego, California, 1305 Harbor Drive
* Saint Louis, Missouri, 3435 Chouteau Ave.
* San Francisco, California, 1077 Howard Street
Springfield, Illinois, 104 South 6th Street



Motor (27)

A new totally enclosed fractional horsepower motor for shaft-mounted fans and blowers. Light weight and small size provide maximum power in minimum space. The new design has extended through bolts which provide a solid mounting face beyond the surface of the end shield. Resilient rings on bearing housings, and optional resilient base, make possible a wide variety of mounting arrangements. The single- and two-speed, totally-enclosed, fan-cooled, shaft-mounted fan and blower motor is designed especially for continuous service under severe conditions of dust and dirt. Designed for applications having moderate thrust, motor is available in one- and two-speed single-phase models, and in single-speed polyphase models, with ratings up to ½ hp.

General Electric Co., Schenectady 5, N. Y.

Lighting Fixtures (28)

New contemporary light fixtures, called the "Decorator" line, have been added to the Moe Light line. Modern in design, the lights are available in three general types: contemporary ceiling-mounted plastic "bubble" lights; pull-down reel types in both "bubble" and reflector shade designs; adjustable plastic shaded wall-mounted plug-in fixtures.

Thomas Industries Inc., Moe Light Div., 700 Oak St., Fort Atkinson, Wis.

Exit Light (29)

Light Warden automatic emergency exit lights and safety signs provide greater safety in plants, hospitals, theatres and other places of public assembly.

Units are designed to operate from regular 115-volt lighting circuit and in addition provide instant, automatic emergency light when source of power fails. This is accomplished by batteries contained within the unit and a relay which closes the low-voltage circuit automatically whenever the 115-volt service fails. Both wet and dry battery operated models are available. Wet battery models contain equipment that automatically keep the battery at a full charge. Dry battery models use standard 6-volt batteries.

Electric Cord Company, 195 William St., New York 38, N. Y.

Instrument (30)

The Brunt faultfinder, Universal Model No. 54, is a portable ground detector and fault locator for use on energized power lines. By means of a voltage selector switch, this instrument may be used on power voltages of 120, 240, 480, or 550, ac or ungrounded dc. It locates grounds on energized power lines, without interfering with continuous production. In use, it transmits an audible signal over the faulted line, until the point of fault is reached, where the signal dies out. This signal enables it to be used in dark or inaccessible locations, and for tracing overhead or buried lines.

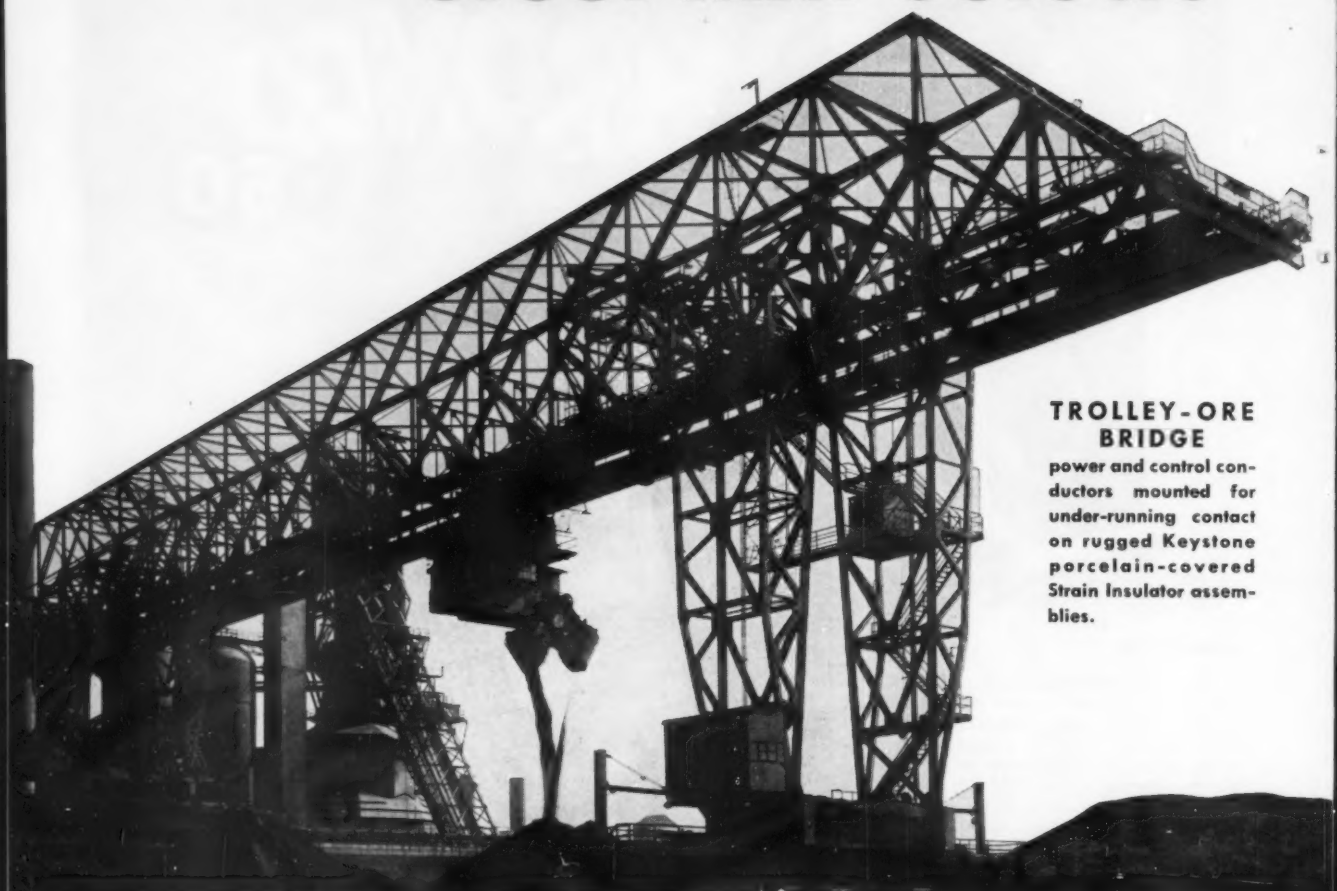
Parr Manufacturing Corp., 44 Austin St., Newark 5, N. J.

Control Units (31)

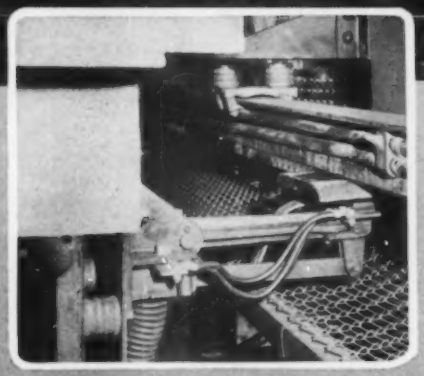
"Channel wiring" is a new design feature of the control units of all-electric adjustable-speed V*S drives. This innovation involves two new approaches to basic principles—leading wires across the surface of the control panels through protective "channels", and coding the wires, by number and color, and no longer showing the actual wires on the diagrams. The result is added protection for the panel wiring, simplification of wiring diagrams, and easier alteration for possible future changes of drive functions. Under the new system the wires are carried in duct-like channels which have perforated sides for the exit of each wire to its proper destination.

Reliance Electric and Engineering Co., 1088 Ivanhoe Road, Cleveland 10, Ohio.

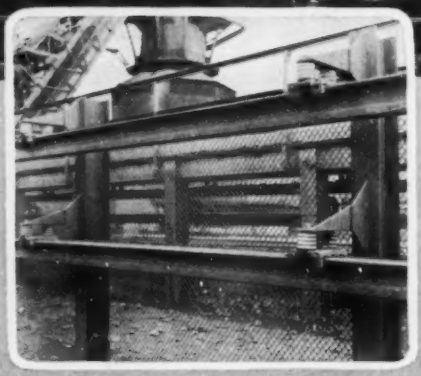
World's Newest Steel Mill Selects



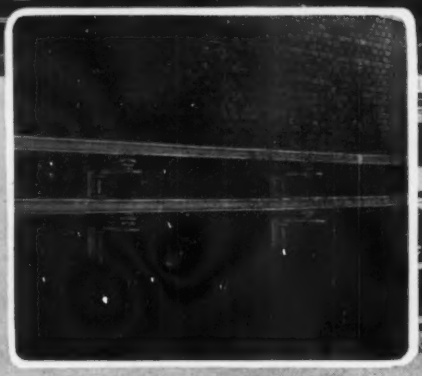
TROLLEY-ORE BRIDGE
power and control conductors mounted for under-running contact on rugged Keystone porcelain-covered Strain Insulator assemblies.



RUNWAY-ORE UNLOADER
Keystone Type PS Collector heavily constructed for severe service. Both contact rails and collectors insulated with Keystone Glastic Insulators.



RUNWAY-ORE BRIDGE
equipped with Keystone Glastic Contact-rail Insulator assemblies for under-running contact-rail service.



COKE QUENCHER
Power rails equipped with Keystone wet-process porcelain petticoat-type Insulators providing long leakage distance for wet, dirty applications.

ELECTRIC SERVICE MANUFACTURING CO.,

SERVICE ENGINEERED

KEYSTONE INSULATORS

FOR UNFAILING PROTECTION

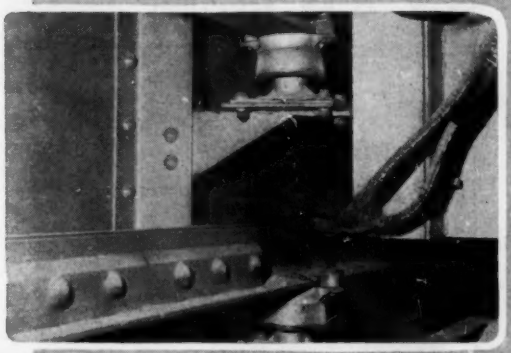
When U. S. Steel engineers built the Fairless Works to be the most modern mill in the world they had to consider every product for peak efficiency. For insulators on power lines and rails Keystone Insulators were selected and installed from the ore unloader right on through the plant.

Keystone Insulators are "service engineered" to take the toughest treatment on all installations. They have been proved and approved by years of unfailing service in the leading industrial plants throughout the world. They include:

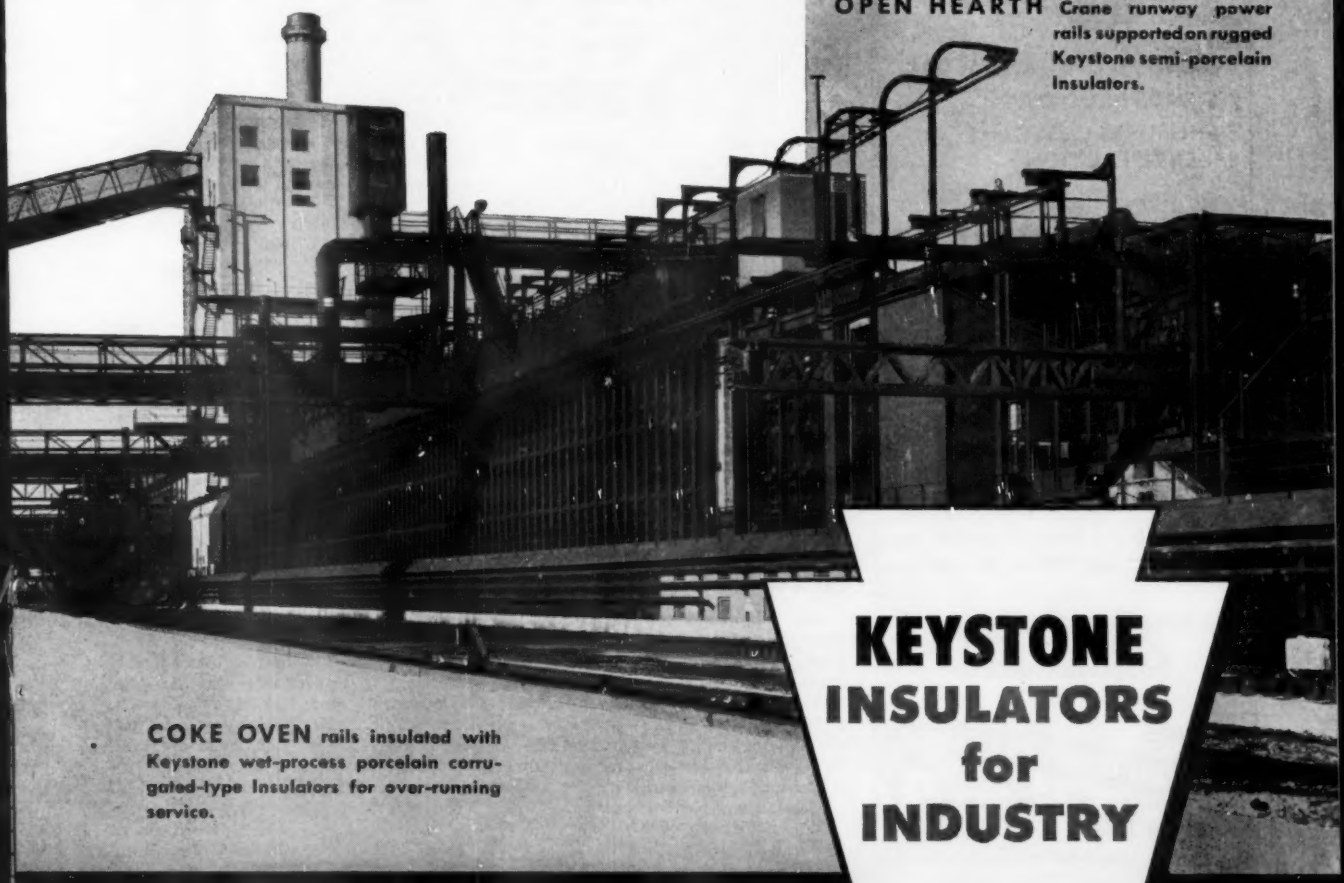
Moulded Glastic Insulators
Wet-Process Porcelain Insulators
Semi-Porcelain Insulators
Moulded Phenolic Insulators

For long, strong life and peak protection there's a Keystone Insulator that is "service engineered" to meet every need in your plant. Let ESM engineers help you select the right mechanical and electrical qualities to solve your problems. Write today for complete catalog on these Insulators, Keystone Collectors and Rail Shoes.

SOAKING PIT Crane runway power conductors equipped with Keystone semi-porcelain type Insulators with Keystone phenolic type Giant Strain Insulators providing double safety.



OPEN HEARTH Crane runway power rails supported on rugged Keystone semi-porcelain Insulators.

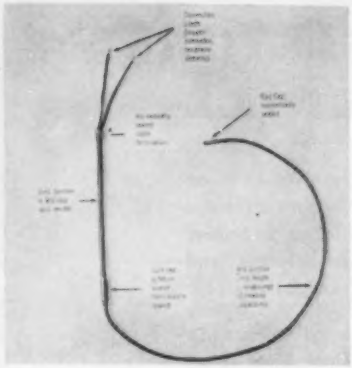


COKE OVEN rails insulated with Keystone wet-process porcelain corrugated-type Insulators for over-running service.

KEYSTONE INSULATORS for INDUSTRY

Philadelphia 32, Pa.

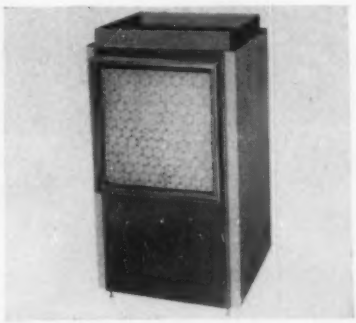
Represented in Canada by Lyman Tube and Bearings, Ltd., Montreal and Toronto



Electric Heating Element (32)

A new type of copper-clad electrical heating element, known as Heatflex mineral insulated heating unit. It can be wrapped around almost anything, immersed in any solution non-corrosive to copper or enclosed in any material. Element consists of a seamless sheath of self-annealing copper in which is enclosed a pair of copper resistance wires, spaced and insulated by a magnesium oxide. Heatflex can be formed to any surface—tanks, pipes, valves, switches—without tools. It can be operated at any temperature from below freezing to 482° F and controlled to precise temperatures. Some of the advantages are heat-resisting, non-inflammable, rugged, self-grounding, compact, flexible, waterproof, chemical resistant, resistant to thermal shock and non-deteriorating. In standard construction, it is less than ¼-in. in diameter. "Hot" and "Cold" sections can be produced in any length to suit job requirements.

Continental Electric Equipment Co., Box 1055, Cincinnati 1, Ohio.



Air Conditioner (33)

New 3-hp water-cooled residential air conditioning unit attaches to existing duct work, is controlled automatically by a heating thermostat, and is designed to cool a 5-6- or 7-room home. Unit includes a hermetically sealed compressor with hydraulic expanding evaporator tubes for high heat transfer, a water-cooled condenser for high efficiency, a self-contained blower fan and plenum chamber.

Mitchell Manufacturing Co., 2525 Clybourn Ave., Chicago, Ill.

Multi-Control Wiring System (34)

A new low voltage multi-control wiring system for controlling lighting and appliance loads in the home. Through the use of small relays, which are actuated by low voltage switches, lighting and appliance circuits may be controlled from one or any number of desired locations. Another feature is the master switch control. One or more master switches may be installed at strategic locations for the control of any number of circuits. Multi-control may be used as an entirely new system or to supplement existing wiring. System utilizes a magnetic relay operated by low voltage switches to control loads. Relay operates on 24-volt current. Master selector switches permit control of numerous circuits from centrally convenient locations. Literature is available.

Bryant Electric Co., Box D, Barnum Station, Bridgeport 2, Conn.

Industrial Fixture (35)

A new fixture with a 25% upward component of illumination is now available for industrial applications. Called the Lifetime CFI-25, the unit has an 8-foot reflector of white porcelain enamel, an 85% reflection factor, ribbed construction to prevent reflector from spreading, longitudinal louvers to provide 30 degree crosswise shielding, and die embossed apertures.

DayBrite Lighting, Inc., 5411 Bulwer Ave., St. Louis 7, Mo.

Photoelectric Relays (36)

Pulsed-beam photoelectric relays, called Modulite equipment, provide electric eye control of industrial and commercial operations. Equipment is unaffected by sunlight, flashlights, headlights, etc. Projector houses a low voltage incandescent lamp fed from a step-down transformer. Light output from the lamp is pulsed by a revolving disc with holes near its outer edge. The disc is placed between the lamp and the output lens. The frequency of the pulse is several hundred times per second. The receiver is tuned to the frequency of the light pulsations and is insensitive to steady light or light at other frequencies. Typical applications include: door control, control of conveyor transfer, materials counting, automatic machines and burglar protection. Units are rated for light distances of 30, 200 and 1000 feet; required supply voltage is 105-125 volts, 50-60 cycles.

Electronic Control Corp., 1573 E. Forest Ave., Detroit 7, Mich.

AUTOMATIC STARTERS

Bulletin 709 solenoid starters in 8 sizes up to 300 hp, 220 v; 600 hp, 440-550 v. Enclosures available for every kind of operating condition.

MANUAL STARTERS

Bulletin 609 manual starters in 2 sizes up to 5 hp, 220 v; 7½ hp, 440-550 v, with 2 accurate thermal overload breakers.

OILTIGHT STATIONS

Bulletin 800T oiltight push buttons for machine tool service. A full line, with or without pilot lights, and single or multiple push button stations.

RELAYS & CONTACTORS

Bulletin 700 solenoid relays from 1 to 8 poles. Contactors up to 900 amps.

LIMIT SWITCHES

Bulletin 801-802T standard and precision limit switches in hundreds of styles and combinations.

Tinius Olsen Milling Machine equipped with Allen-Bradley manual and automatic motor controls.

WHEN YOU ARE UP AGAINST A MOTOR CONTROL PROBLEM

Look for the answer IN THE A-B HANDY CATALOG

Motor control requirements are becoming more and more complex . . . with more limit switch circuits . . . more relays . . . more timers . . . more push buttons. You can find the right combination of control units in the Allen-Bradley Handy Catalog—have a copy on your desk for quick and easy reference. It is a 120-page motor control guide with ratings, dimensions, and prices of starters, relays, limit switches, drum controllers, rheostats, push buttons, and many other accessories.

Look for the answer to your motor control problems in the Allen-Bradley Handy Catalog. Write for your copy, today. Remember, Allen-Bradley control is Quality Control!

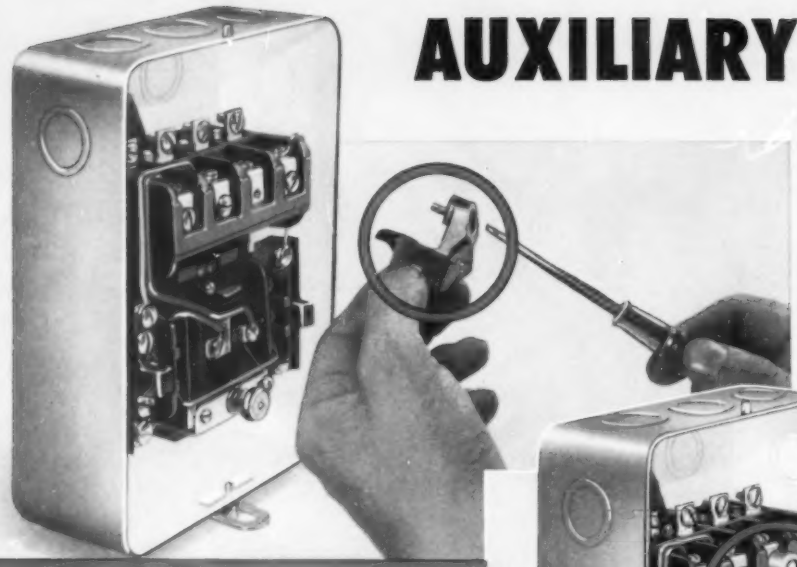
Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.
In Canada—Allen-Bradley Canada Limited—Galt, Ont.

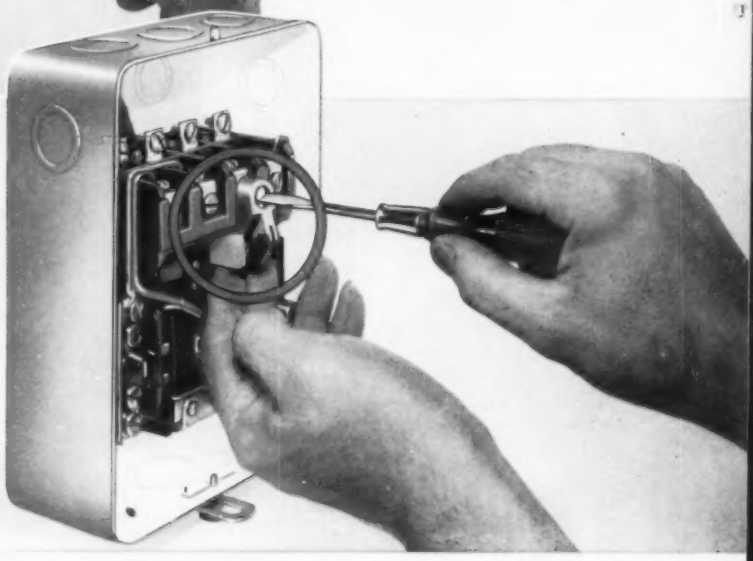
ALLEN-BRADLEY
QUALITY
TROUBLE FREE MOTOR CONTROLS

10—54—M

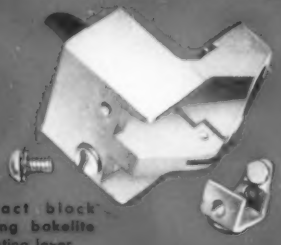
AUXILIARY CONTACTS

SO EASY TO INSTALL on ALLEN-BRADLEY Solenoid Starters

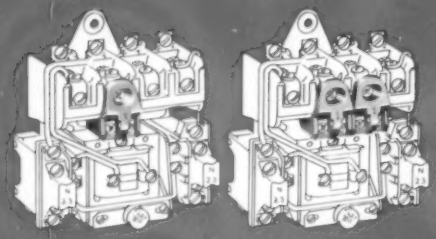




SIZE 1 AUXILIARY CONTACT

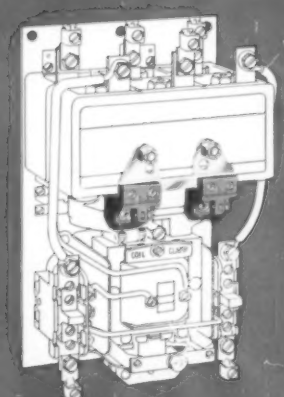


Contact block showing bakelite operating lever.



Bulletin 709 Size 1 solenoid starter with one auxiliary contact on hood.

Same starter equipped with two auxiliary contacts on the arc hood.



Bulletin 709 Size 3 solenoid starter with two Bulletin 895 auxiliary contacts on one mounting plate, which is attached to the arc hood of the A-B solenoid starter.

The same mounting plate, with either one or two auxiliary contacts, can be used interchangeably on Size 2 and Size 3 solenoid starters.

All Bulletin 895 auxiliary contacts have "Pilot Duty Rating."

Existing control wiring need not be disturbed to install Bulletin 895 auxiliary contacts on an A-B starter.

NOW—with these new Bulletin 895 auxiliary contacts, you can add to your Allen-Bradley starters extra pilot circuits for operating relays or pilot lights. They are quickly attached to the arc hoods of Sizes 0 to 3 solenoid starters. (See line drawings at left.)

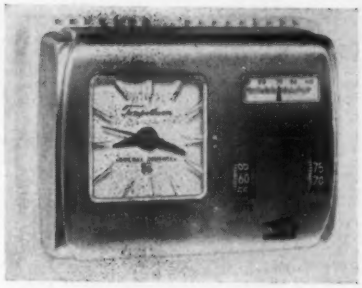
Two contact arrangements are available... one has either a normally open or a normally closed contact... easily changed from one to the other. The other has both a normally open and a normally closed contact. Bulletin 895 contacts are available for Sizes 0 and 1 starters, while the construction for Sizes 2 and 3 starters is the same.

These auxiliary contacts are operated by the solenoid plunger. Terminals are front connected. The double break, silver alloy contacts need no maintenance.

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.
In Canada—Allen-Bradley Canada Limited—Galt, Ont.

ALLEN-BRADLEY
QUALITY
TROUBLE FREE MOTOR CONTROLS

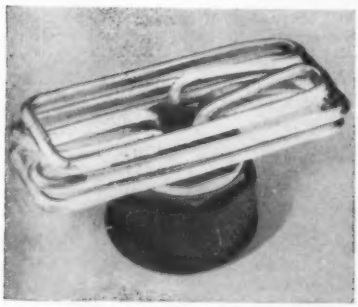
10—54—M



Thermostat (37)

Tempotherm is a new electric clock-type, day and night thermostat. Styled in satin-finished stainless steel, it automatically lowers and raises temperatures. Two basic models are available for operation of 24-volt 2-wire heating control systems. One is designed for modernization purposes and a plug-in transformer to supply current for the clock. It is also furnished with an extended base to cover any wall markings left by the original thermostat. The second model—for new construction—has a base which fits a standard 2 by 4 junction box mounted in horizontal position. Finger-tip roll dials with easy-to-read markings are provided for selecting day and night temperatures. Mercury-switch operation. Unit is equipped with a clock motor especially designed for cool operation.

General Controls Co., Glendale, Calif.



Coffee Urn Heater Unit (38)

A 3-phase electric coffee urn heater unit has been developed for the commercial cooking field. It is designed to simplify wiring at installations where 3-phase power supply is available—at new or modernized restaurants, hotels, clubs, or diners. Designated as Chromalox type TTUH, the element comes in a wide range of sizes and ratings, is adaptable equipment. Unit can also be used in steam tables or other containers with a minimum water depth of 2½ inches. Unit has tubular-type, copper sheathed heating elements. An accessory 3-heat, 3-phase switch permits heating at ¼, ½ or full power, but automatic control can also be provided by thermostat to maintain precise temperatures. Capacities range from 1,000 to 6,000 watts, while voltage ratings of 120, 208 or 240 are available in all wattages.

Edwin L. Wiegand Co., 7637 Thomas Blvd., Pittsburgh 8, Pa.

Welders (39)

A complete new industrial line of low maintenance, ac welders for high speed production. The line consists of NEMA rated 300-, 400- and 500- amp models. Welders feature stepless current control, silicone insulation, aluminum coil windings, and are equipped with a large current scale, which the operator can read from a considerable distance without returning to welder. Fingertip current adjustment and quieter operation are made possible by a new feature in which the coil supports float in a special rubber bushing. Wide current ranges on the welders enable them to be used on practically all industrial applications ranging from light-duty, low current, to heavy-duty, high current welding jobs. Designated 6WK-30L, 6WK40L, and 6WK50L, the units are available for 220/440- or 550-volt operation. Bulletin GEC-1259 is available.

General Electric Co., Schenectady 5, N. Y.

Lighting Unit (40)

Six new decorative "Calculites" are available for downlighting special areas in residences, restaurants, lounges, hotels or showrooms. One is particularly recommended for re-lighting projects, for its wide dome covers ceiling holes left by obsoleted fixtures. The other five are equipped with special Colouvered lenses, the vertical surfaces of which are fused with tiny beads of warm-tinted glass. Heat resistant reflectors and brass trimmings are also included. These Calculites come in several basic designs and in various sizes. Features of fixtures include pre-wiring, adjustable plaster frames, mounting bars for wooden joist construction and special springs to facilitate relamping.

Lightolier, Inc., 11 East 36th Street, New York, N. Y.

Control (41)

The new Bendix-Friez automatic humidistat control is a automatic control to operate electrically powered humidifiers and dehumidifiers up to ⅓ hp. Control operates in much the same manner as the room type thermostat. Hang it on the wall and plug it directly into the wall outlet. Plug in the humidifier or dehumidifier. When instrument is used with dehumidifier and moisture content of air rises above the set level, the control turns on the dehumidifier. When moisture content of air drops below set level, the

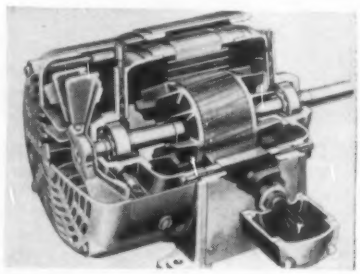
control turns off the dehumidifier. When specified for use with humidifiers, it works on the opposite cycle again turning the units off and on as required.

The Abbeon Supply Co., 179-15 Jamaica Ave., Jamaica 32, N. Y.

Fused Caps (42)

Fused plugs, designed to accommodate standard NEC fuses (renewable, 1-time or dual elements) fit all receptacles now in use and will furnish protection to circuits serving appliances or stationary tools. Attractive in appearance, these Groundsafe plugs provide individual fusing for many devices, preventing outage of other devices on the same circuit in case of a short. They are easy to fuse and wire, come as 2- or 3-pole units, grounded or ungrounded. Three different types of fuses are available for voltages up to 600.

Novelty Electric Co., 10th and Cherry Streets, Philadelphia 7, Pa.

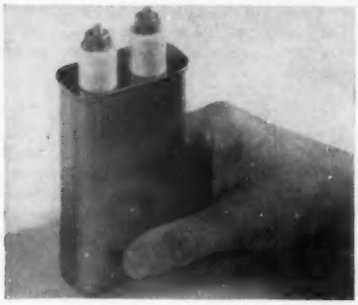


Motor (43)

A new motor specially designed for chemical services. It is totally-enclosed and corrosion protected, designed for dangerous and damaging atmospheres. It incorporates specific features for these drastic services including a stainless steel stator band surrounding the inner enclosed case, a stainless steel fan cover guard, cast-iron conduit box sealed with a non-deteriorating, impervious compound, cast-iron ventilating fan for the totally enclosed design or a cast bronze fan for explosion-proof service with UL label, cadmium plated screws and fittings exposed to the atmosphere, elongated bearing caps, and a double-sealed moisture

drain. The chemical motor, designated as Types SD and SE, is produced in ratings from 3 to 150 hp. Bulletin 1810 is available.

U. S. Electrical Motors Inc., Box 2058, *Los Angeles* 54, *Calif.*



Capacitors **(44)**

New fixed paper-dielectric capacitors in drawn rectangular cases. These capacitors for motor, industrial control, filter, luminous-tube transformer, and other ac or dc applications were previously available in drawn cases, but only in oval styles. New units have the same base area as those in fabricated cases and are interchangeable with them, allowing users to switch to the new capacitors without changing existing drawings. Since bottoms of cans are indented, units can be mounted in an inverted position, as well as upright. Available in capacitance ratings of .05 microfarad to 16 microfarads and voltage ratings of 400 volts to 12,500 volts dc and 236 volts to 660 volts ac.

General Electric Co., Schenectady 5, *N. Y.*

Product Briefs

(45) P. K. Neuses, Inc., Arlington Heights, Ill., has announced a new contact burnishing **tool** which is nonresidual. . . . (46) Triangle Conduit & Cable Co., Inc., New Brunswick, N. J., is now producing all of its service entrance **cable** with a silver finish. . . . (47) Whitney Blake Company, New Haven, Conn., now offers a new series of rubber molded three prong male **plugs** designed to meet the requirements of Article 250 NEC.

(48) Anaconda Wire & Cable Co., New York, N. Y., has announced that Durall-T, a thermoplastic-insulated and jacketed **cable,** now is approved as Type UF, for much more severe service, under the new underground-feeder classification of the 1953 N E C. . . . (49) A new precision general purpose electronic **timer** with 1% accuracy for interval timing, timed delay, repeat cycling, programming or pulsing, is manufactured by Ferrara, Inc., Oak Park, Mich. . . . (50) Reliable Electric Co., Chicago, Ill., has announced that Strandlinks and Strandvises are now available for $\frac{7}{16}$-in. **strand.**

(51) James G. Biddle Co., Philadelphia, Pa., has announced a new Model 3 Corona **test set** designed to facilitate nondestructive testing of the insulation in electrical equipment. . . . (52) Duro-Test Corporation, North Bergen, N. J., has developed a new **fluorescent light** called Super-Candelite. . . . (53) The Perkin Engineering Corp., El Segundo, Calif., has developed a new 200-amp magnetic amplifier regulated **power supply.**

(54) Hess, Goldsmith & Co., New York, N. Y., has introduced a new woven fiber glass tubular **sleeving** which cannot be stretched under tension and will not lose its tubular shape when filled or pulled. . . . (55) Auburn Machine Works, Inc., has developed a new **trencher** called Jeep-A-Trench Gear-Draulic, which is a gear driven trencher with gears running in oil. . . . (56) Anaconda Wire & Cable Co., New York, N. Y., has added soldersealed **potheads** to its line of cable accessories.

(57) Feedrail Corporation, New York, N. Y., has available a complete line of Feedrail trolley mounted **cleaning tools** to aid in maintenance. . . . (58) Tip Top Electric Products Co., New York, N. Y., has developed spot welding and soldering **pliers** for light industrial and shop use that works off any automobile storage battery of 6-12 volts.

CATALOGS and BULLETINS

(59) FIXTURES. Colorful new 20-page catalog 9 covers an extensive line of recessed incandescent units, each available with a choice of five lens styles. Dimensions and distribution curves are included. Attractive ceiling, bracket and portable fixtures in seven decorator finishes are illustrated and described. Prescolite Mfg. Corp.

(60) SIGN LIGHTING SOURCES is the title of a new booklet covering dimensional and performance data on all types of sign lamps: incandescent, fluorescent, floodlight, spotlight and blacklight, as well as colored tubing. Sylvania Electric Products Inc.

(61) WIRING DEVICES. 4-page supplement to catalog 1-54 lists 39 new items in the line including 20-, 30- and 50-amp devices and caps. Slater Electric & Mfg. Co., Inc.

(62) ACOUSTICAL CEILINGS. Electrical men who work frequently with this type of installation can obtain a good basic knowledge of the various methods of hanging, standard sizes and light reflection properties.

Design Data AC6.A1. Owens-Corning Fiberglas Corp.

(63) LOW VOLTAGE WIRING SYSTEM offers the convenience of controlling lighting and appliance from any number of switching points. Up to nine circuits can be controlled from any location. 6-page bulletin describes operation of the 24-volt control system and components. Bryant Electric Co.

(64) CONVEYOR-OVEN for baking coils and miscellaneous small assemblies can provide temperatures up to 900 degrees F. This portable unit is 10-ft long with a 12-in. wide belt; rating is 4000 watts at 230 volts (115 volts if specified). 2-page sheet. Miskella Infra-Red Co.

(65) RESIDENTIAL LIGHTING. 96-page full-color catalog illustrates 317 modern home lighting units, both incandescent and fluorescent. Lightolier, Inc.

(66) BLOWERS AND EXHAUSTERS for applications requiring 1 to 9 lbs per sq in. air pressure or vacuum from 2 to 12 inches of mercury. Multistage centrifugal units deliver air at constant pressure despite variations in volume. 12-page bulletin M-103 describes design features and capacity ranges. Air Appliance Div., Hoffman Machinery Corp.

(67) TAPE. 20-page "Permacel" catalog gives complete physical and electrical properties of 18 types of pressure-sensitive electrical tape designed for a wide range of applications. Insulation Manufacturers Corp.

(68) TRANSFORMERS designed for use as near as possible to the center of the load minimize costly low-voltage runs and improve power characteristics. Unique system of charts in 20-page Catalog 132 simplifies determination of weights, dimensions and performance for units up to 2500 kva, with or without auxiliary equipment. R. E. Uptegraff Manufacturing Co.

(69) INTERIOR LIGHTING EQUIPMENT. 12-page bulletin F gives complete data on silver-mirrored permaflectors for indirect cove lighting. Apparatus for strip lighting, interior spot and flood lighting is also covered in detail. Pittsburgh Reflector Co.

(70) TRANSFORMERS for subway distribution applications feature the new "Curvacore" design which affords a 25% to 30% weight reduction. Available in ratings of 15 to 167 kva, single phase, and 15 to 150 kva, three

phase. Bulletin 61B6333A, 6 pages. Allis-Chalmers Manufacturing Co.

(71) REPEAT-CYCLE TIMER provides two independently adjusted on-off cycle controllers in one unit. Timers are listed in nine dial ranges from 30 seconds to 4 hours. Rating is 15 amps maximum at 115, 230, or 460 volts ac. 4-page bulletin N-80. Automatic Temperature Control Co., Inc.

(72) BUILT-IN LIGHTING. 50-page catalog contains complete construction and performance information with illustrations of incandescent and fluorescent units and outstanding installations. Kirlin Co.

(73) HEATING CABLE enclosed in copper sheath can be immersed in any material not corrosive to copper, is operable in temperature environments from freezing to 482 degrees F. 8-page Heatflex catalog. Continental Electric Equipment Co.

(74) BATTERY CONNECTOR for use with currents up to 175 amps and voltages to 110, features sure-contact locking action and strong mechanical protection for conductors. Yale & Towne Mfg. Co.

(75) POTHEADS. Revised 18-page catalog describes installation methods, dimensions and accessory parts for compound-, oil-, and gas-filled Solder-sealed potheads in ratings from 15 to 46 kv. C-79-1330. Anaconda Wire & Cable Co.

(76) WIRE MARKERS are adhesive stickers available with either numbers, phase letters or various special circuit designations imprinted. 8-page bulletin 130-B describes complete line. W. H. Brady Co

(77) CHALKBOARDER is a simple fluorescent unit designed for illuminating vertical surfaces such as classroom blackboards. This adjustable fixture houses the ballast in a wall-mounted box. Maximum lamp distance from wall is 12-in. Available in 4-, 8- and 16-ft lengths. Smithcraft Lighting Div.

(78) INFRARED BROODER FIXTURES are available with or without thermostats and guards in capacities from 100 to 500 chicks, using from one to six R-40 heat lamps. Bulletin 130-55, 4 pages, gives other suggested applications of these units. Steber Manufacturing Co.

(79) INSTRUMENTS. General bulletin lists and illustrates complete line of recording, automatic controlling, and telemetering devices including a new line of metagraphic pneumatic transmission instruments. DMO35. Bristol Co.

(80) VOLTAGE REGULATORS of the rocking contact type are detailed in two bulletins giving description of components, theory of operation, dimensions and wiring diagrams. 3090 covers units designed for ac generators rated from 20 to 438 kva; 2095 for generators from 438 to 1175 kva. Brown Boveri Corp.

(81) ANNUNCIATORS are the subject of bulletin 854 which also covers sealed and non-sealed relays. H. R. Kirkland Co.

(82) CUSTOM-CUT CABLE of the shielded and multi-conductor types is now available in any multiple-of-25-ft length. Catalog R-33 lists styles of wire included in this unique service. Alpha Wire Corp.

(83) HOLIDAY LIGHTING KITS for indoor and outdoor use include portable fixtures, lens holders and colored lenses. Bulletins 1040-54 and 1050-54. Steber Manufacturing Co.

(84) STAGE LIGHTING SYSTEM designed specifically for elementary schools features flexibility and opportunity for progressive installation over a period of years. Components are: strategically located outlet "pockets" installed in floor and adjacent to Unistrut hanging tracks in ceiling; circuit breaker panelboard with cords and jacks for each circuit and receptacles for 4 dimmer boards. Bulletin ES-54, 12 pages. Hub Electric Co.

(85) PILOT LIGHTS. Practical and design factors that enter into the selection of pilot light assemblies are covered in 8-page brochure L 155. Dialight Corp.

(86) VENTILATING EQUIPMENT. 26-page catalog 151 includes specifications and installation data on propeller fans in portable, kitchen, tubeaxial, centrifugal, roof ventilator and other types. Ilg Electric Ventilating Company.

New Books

Lighting Handbook (87)

This revised edition deals generally with the science and practice of lighting and is not restricted to specific items of equipment although it includes distribution curves and allied data for standard light sources and reflectors. Practical techniques for meeting special lighting problems are suggested. Westinghouse Lamp Division, Bloomfield, N. J. 250 pp. $2.50

Neoprene jacketing protects wiring against moisture, heat and chemicals in paper mill

Extreme conditions of exposure proved too much for Type RW wiring jacketed with saturated cotton braid used in "wet locations" of the Ecusta Paper Corporation in North Carolina. Moisture, heat and chemicals caused wiring to fail after five or six years.

Then neoprene-jacketed wiring was installed, and failures on this wiring have been practically non-existent. In the bleach building shown above, for example . . . even after six years of exposure to hot, steamy air, daily hosings, chlorine and caustic soda . . . neoprene-jacketed wiring continues to give trouble-free service.

Now Ecusta uses neoprene-protected wiring exclusively in wet locations. During the last six years, many thousands of feet of this wiring have been installed—for 600-volt A.C. power and control circuits, and for all 5000-volt A.C. feeder circuits.

FOR OUTSTANDING DURABILITY, specify neoprene-jacketed wire and cable. Rugged neoprene withstands soil acids and abrasion in the ground; exposure and sunlight in the air; heat, grease and chemicals anywhere. See your supplier about neoprene-jacketed wire and cable. They're available in voltage ratings to fit your specific needs.

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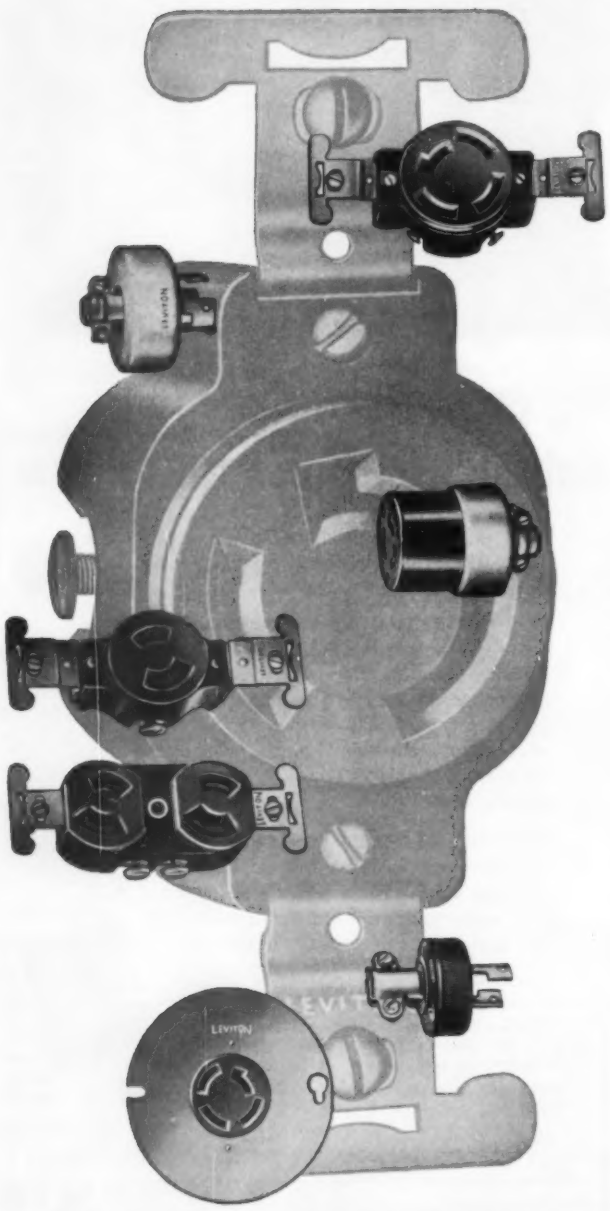

. . . providing safe dependable connections under severest conditions of vibration, motion or accidental pull-out.

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These new LEV-O-LOCK devices incorporate every up-to-the-minute advance in design and engineering. Just a turn of the cap provides a secure connection that will not shake loose . . . that assures uninterrupted power flow. LEV-O-LOCK devices are a must for factories, offices, farms, ships; in the operation of portable power tools, machinery and office equipment. New features include *double wiping contacts in all receptacles*, made of heavy gauge phosphor bronze. Extra large terminal screws and ample room make wiring fast and easy. Rigid quality control from raw material to final inspection is your assurance of a superior product. *Send for bulletins LL and NPB 16.*

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QUESTIONS from readers on problems of industrial equipment, installation, maintenance and repair. Answered by electrical maintenance engineers and industrial electrical contractors out of their experience. For every question and every answer published we pay $5.00.

Reader's Quiz

Welder Trouble

QUESTION S26—Recently I was called to check trouble on an electric welder, the motor of which was 3-phase, 400-volt. It was not carrying the load and then it would blow a fuse. I finally found that in the cable leads to the motor, the green wire was connected on one end to the ground properly but on the other end it was a phase wire.

This machine had been operating properly for over a year carrying its heavy rated loads many times while used in heavy-duty work. The question is, why did the trouble develop after all this time? There was no breakdown of any coils, etc.—C.S.S.

ANSWER TO S26—We have had a number of cases of this same thing happening. What actually happens is that the welder operates on a grounded delta system in which one leg of the secondary is grounded. This will operate indefinitely this way until a ground occurs on another leg with the result that you actually have a short between phases thus blowing the fuse. —E. T.

ANSWER TO S26—One phase of the power was grounded to the welder frame, and the same phase of the welder motor was grounded. Therefore, the ground was being used to supply the welder with one phase and the welder operated satisfactorily.

Now there are three possible solutions—but first was the welder frame effectively grounded?

1—If it was and still is, then another ground developed and gave a partial short circuit or overload that blew the fuses.

2—If it was and is no longer, then one phase was lost and the welder was trying to single phase. This is questionable if the welder is still in good condition unless Fusetrons or double element fuses were used.

3—If it never was, then there was a solid ground on that phase somewhere that was removed with the same result as solution No. 2. It might also be that this ground is still intact and a third ground developed the same result as solution No. 1.

It is not unusual in residential trouble shooting to find a ground a block away causing trouble. In a shop or plant the first ground does not cause trouble, it is the second one. On unexplained troubles it is good practice to look for a ground. Ground lights or a ground indicator on plant substations are good insurance. They give time to find the first ground and clear it before a second gives trouble.—C.H.Z.

Selective Switching

QUESTION ON T26—It is known that a condenser blocks out dc but allows ac to flow through. Our problem is just the reverse. We have an automatic 3-pole throwover switch that is used for selective switching of a 110-volt dc motor and a 220-volt 60-cycle 3-phase motor. In the control circuit it becomes necessary to block out 220 volts ac from entering the 115-volt dc coil during the transition period.

If there is such a checkvalve, can some reader describe how to go about making one or to figure out what is needed and where to purchase it? The coil load or current is approximately 1-amp at 115 volts dc—L.G.D.

ANSWER TO T26—What is wanted here is an inductor. The reactance of the inductor will block out the ac, whereas the only obstacle to the flow of dc current will be the resistance of the winding. Unfortunately it is not possible to get a perfect inductor in the sense that it will completely block out the ac and leave the dc unaltered. You do not say what the ac current is, and this becomes important from the viewpoint of the size of inductor to suggest. What should be done is to figure the maximum ac voltage permitted across the control circuit under your switching conditions and then to decide the inductor accordingly. —H.H.S.

Overloading Transformers

QUESTION U26—All transformer manufacturers have compiled printed tabulations showing allowable overloading peaks. We have a number of units that have consistently operated within these published figures. Do any readers have their own formula for overloading transformers, especially with excess loadings over the manufacturer's listing which have been satisfactory?—L.W.F.

ANSWER TO U26—Transformers can be safely operated at their maximum load by installing a fuse to limit the top short time current, and a thermostat to limit the temperature caused by short time overloads.—H.S.

ANSWER TO U26—We have discussed your problems at length and have found no particular formula for transformer overloading.

The limitations established by the American Standards Association are used extensively as to oil temperature and hot spot temperature. The ambient temperature and hot spot temperature are guiding factors as is the load factor. The load factor averages out so that for a specified time interval that the transformer is loaded below 100%, it may be overloaded percentagewise so that there is no loss of transformer life. This is all calculated in tabular form under load factor and daily overloads.

However, the temperature limitations are the governing factors as the insulation, which is the life of the transformer, is so affected by temperature.—J.B.K.

ANSWER TO U26—A human analogy may answer a question which is asked time and again, not only in connection with transformers but rather with all types of electrical equipment: What happens when the specified rating (hence the specified temperature limit) is exceeded?

Consider a group of 100 working men. Under present-day conditions (in this country) they work eight hours per day, and their life expectancy (in this country) is maybe 68 years. If these 100 men were forced to work 12 hours a day, as they did 50 years ago, will it not be safe to assume that their life expectancy will be reduced? No doubt, it will. It will be reduced as a group, though not necessarily for each individual.

It may well be that one user, or another, of electrical equipment has no adverse experience in overloading it beyond specified limits. He may have

been lucky in having acquired a particularly sturdy piece. However, considering the "population", that is the entire group, there is no doubt whatsoever that exceeding specification limits will reduce useful life to a point where no returns accrue. Electrical insulation is particularly sensitive in this respect: a temperature increase of 10 to 20 deg. F (depending on the type of insulation used) cuts the useful life expectancy in half.

It is not considered poor engineering practice to overload equipment in emergencies, for a limited time—who has not worked 12 hours or even longer under emergency conditions? However, any consistent overloading simply does not pay.—L.F.R.

AC Motors

QUESTION V26—Has anyone successfully constructed ac motors of the series, shunt and compound types by using rectifiers and filters to get dc for the fields, and letting the armatures remain ac? These ac motors might have the advantages of dc motors without the disadvantage of commutators. How feasible are these motors? What are the obstacles to their construction? What would their characteristics be?—E.B.

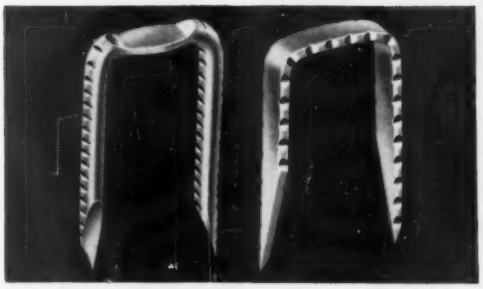
ANSWER TO V26—The idea of eliminating commutation by utilizing ac on the armature of a dc shunt motor while supplying dc to the fields resulted in the synchronous motor. A direct conversion is not possible since the armature must be wound for polyphase operation. To carry the heavy load current without the need of slip rings, the armature is wound on the stationary part of the motor, that is, the stator. The relatively light current for the dc field poles is supplied through slip rings from a dc bus, a motor-generator set, or a rectifier. Of course, series or compound dc motors utilize the same current for both armature and series fields and, therefore, there is no comparison.

The synchronous motor has characteristics desirable for some applications, namely: constant speed, high power factor, and somewhat higher efficiency.—W.E.T.

ANSWER TO V26—AC motors cannot be successfully built to operate with ac armatures and dc fields. This applies to series, shunt, and compound types. The reason is that if the current changes direction in synchronism with the frequency in the armature, then it must change direction at the same

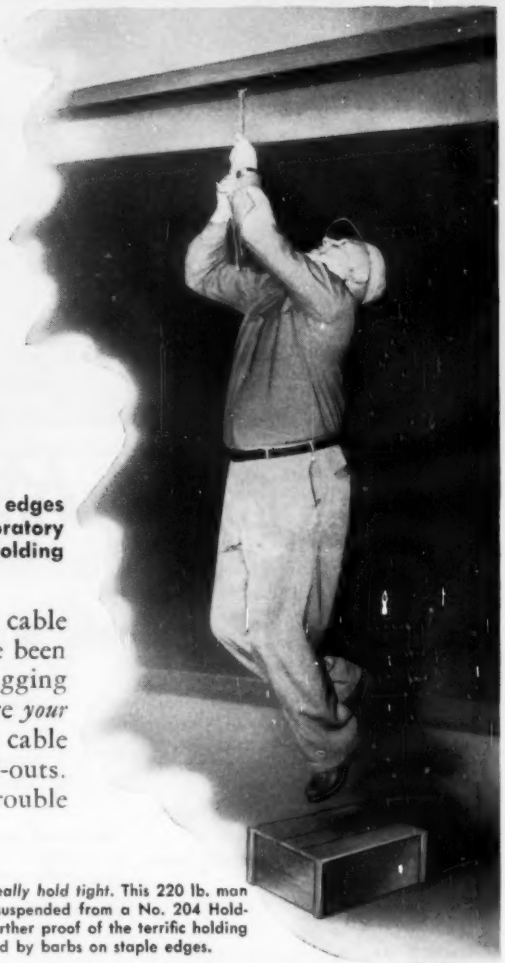
AMAZING NEW CABLE STAPLES

provide up to 67% greater holding power . . . keep your cable installations up and safe.



New Titchener "Hold-Tite" Cable Staples have barbed edges which grip the wood and hold firmly. So firmly that laboratory tensile machine tests show readings up to 67% greater holding power over same size ordinary staples.

Hold-Tite Staples Keep Cables Up and Safe. Ordinary cable staples often drop out or pull out after they have been in place a few days. This lets the cable sag. Sagging cables are dangerous. Use Hold-Tites to make sure *your* installations of metallic and non-metallic flexible cable will stay up the way you put them up. No pull-outs. No sloppy, dangerous sagging cables to cause trouble and hurt your reputation for workmanship.



"Hold-Tites" really hold tight. This 220 lb. man is completely suspended from a No. 204 Hold-Tite Staple. Further proof of the terrific holding power provided by barbs on staple edges.

Will Not Bend Out of Shape! Hold-Tite Staples are made of special analysis steel which doesn't bend or deform, even when pounded into hardest woods. Sharp, even points start straight, go in easily.

A Complete Line. Hold-Tites are available in six sizes. Four sizes in flat wire type (⅞", 1", 1⅛", 1⅜" inside length), two sizes in round wire, E-Z Drive type (1", 1¼" inside length).

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Send me a free box of new Hold-Tite staples. I want the:

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frequency in the fields, else no torque would be created.—E.A.McF.

ANSWER TO V26—Hundreds of inventors have tried unsuccessfully to construct ac motors with dc fields and no commutator. The Patent Office rejects their applications as unworkable, usually quoting from Karapetoff's "Experimental Electrical Engineering." This book shows briefly the fallacy of the idea, i.e., there is no way to get the current in and out of the armature except by use of a commutator. If you use slip rings, you have a simple synchronous motor, which requires special starting means and is suitable only for constant speed service. All ac motors were of this type until the invention of the revolving field induction motor by Tesla. The induction motor requires neither slip rings nor commutator because transformer action between the stator winding and the rotor winding induces current in the latter. Obviously, with dc in the stator, there can be no transformer action and the only way of getting current into the rotor would be by slip rings or commutator. This then is the fallacy, as pointed out by Karapetoff.—S.O.H.

Can you ANSWER these QUESTIONS?

QUESTION F27—We have a large factory operation with over 700 motors spread through a large group of buildings. At the present time, electrical maintenance is handled on a centralized basis. We are considering the establishment of area maintenance stations. Which are best?

Management frowns on the area plan pointing out that much time will be non-productive for the assigned electricians. Our argument is this permits them to become thoroughly familiar with the specialized equipment and processes. Also there is the matter of the "personal" interest angle, from regularly assigned electricians, looking after the equipment, which cannot be actually evaluated.

Perhaps there are other arguments, pro and con, for these proposals that we have not listed. What are they?—L.W.F.

QUESTION G27—When opening and closing 33,000-volt fused disconnect switches, what methods are considered safest? Should the operator stand on an insulated platform; what length should the stick be; should a rain shield be used and if so, how grounded?—M.D.

QUESTION H27—What would be the best way to protect 3-phase motors from single-phase fault on a system which has single-phase 4160-volt primary, Scott connected transformers? The neutral ground is run from the main substation to make the 3-phase current. The main transformers are Y connected at 4160 volts. The secondary is open delta, 3-phase, 440 volts. On one occasion the primary neutral opened at the station and single phased the secondary, which burned out a motor. The magnetic contactor was found to be welded at the contacts.—E.S.H.

QUESTION J27—Does anyone know of an especially good type of heater or method of thawing the outlet valve on the bottom of oil tank railroad cars in severely cold weather?

Due to the difference in specific gravity, most of the condensation or water settles into this valve.

The shape is such that a heating cable cannot be well attached, and an electric heater is far from being ideal. It is slow to operate and also oil drips onto the heater.—M.C.T.

QUESTION K27—We have a condition where we are operating a circuit at pretty well full load with momentary overloads not exceeding 10% of the fuse rating. The fuse is a 20-amp plug-in type of fuse, 115 volts ac. Quite frequently the fuse goes, and when we put in another fuse, the circuit behaves properly again.

When a plug fuse is operated at or slightly beyond its capacity for any length of time, does the fuse tend to go at a lower current rating later on or what exactly happens? I have heard of fuse embrittlement, but there is no vibration here.—H.H.S.

QUESTION L27—If a synchronous condenser or a synchronous motor were connected to a system fed from a synchronous generator and an induction generator, could the synchronous generator be taken off the system for maintenance purposes without shutting down the system? Assume that the induction generator is not overloaded and synchronous condenser or synchronous motor large enough to supply the excitation current the induction generator may need.—E.B.

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Alcoa® Aluminum Rigid Conduit, especially resistant to industrial atmospheres that often attack other metals, costs less than any other corrosion resistant conduit. The excellent performance of aluminum conduit in corrosive conditions means lower maintenance costs and less frequent replacement.

In addition, Alcoa Aluminum Rigid Conduit is nonmagnetic, lowers voltage drop, eliminates overcrowding of terminal enclosures and simplifies the installation of electrical equipment having widely spaced terminals.

Alcoa Aluminum Rigid Conduit reduces handling, fabricating and installation costs. It is only about one-third the weight of the same size in steel. A 10′ length of the 4″ size weighs only 33 pounds and can easily be handled by one man.

Alcoa Aluminum Rigid Conduit is approved by Underwriters' Laboratories, Inc. and each piece bears their label. Readily available. Call your local Alcoa sales office, listed under "Aluminum" in your classified directory. ALUMINUM COMPANY OF AMERICA, 2108-L Alcoa Building, Pittsburgh 19, Pennsylvania.

For complete information write for Alcoa's new booklet, *Alcoa Aluminum Electrical Rigid Conduit.*

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Questions on the Code

Answered by

B. A. McDONALD, *New York Board of Fire Underwriters, Rochester, N. Y.*
GLENN ROWELL, *Electrical Engineer, Fire Underwriters Inspection Bureau, Minneapolis, Minn.*
B. Z. SEGALL, *Consulting Electrical Engineer, New Orleans, La.*

Fire Pump Motors

Q. *I would appreciate a ruling from you on the following question pertaining to a pending installation.*

Fire pump installation, 400-*hp.* 2400-*volt, two-winding, two-speed motor,* 1200/1750 *rpm. Low voltage starter or across the line starter. Would the installation of a two-speed motor on a fire pump be a violation of the National Electrical Code?*—J.J.S.

A. The N. E. Code, under Section 4321, recommends that procedure concerning the installation of fire-pump motors be in accord with the National Fire Protection Association pamphlet No. 20, titled "Standards for the Installation and Operation of Centrifugal Fire Pumps." Section 4372c calls attention to the hazard which would result if a control circuit on a fire pump were opened accidentally. Section 2321a permits a separate service for the operation of a fire pump. This appears to be the extent to which the N.E. Code covers this subject. In the absence of any Code ruling on the question you have raised, reference should be made to NFPA pamphlet No. 20, copy of which may be obtained from the office of NFPA, 60 Batterymarch Street, Boston 10, Mass.

A review of this pamphlet will, I am sure, impress you with the importance of a fire pump installation and the variables which enter the picture in arriving at the proper procedure. As a result, this pamphlet, under its introduction, advises that "Centrifugal fire pumps shall not be purchased until the conditions under which they are to be installed and used have been examined by the authority having jurisdiction, and each pump, driver, controlling equipment and water supply have been approved by that organization."

This pamphlet recognizes the use of squirrel cage or wound rotor types of ac motors as suitable for driving a fire pump. It does not however cover the question you have raised concerning the use of a two-winding, two-speed motor. As a result, this question may only be answered by the authority having jurisdiction. Since the installation of fire pumps usually involves insurance rates, the authority having jurisdiction would be the local insurance inspection bureau, department or organization. This procedure is essential if maximum recognition for the fire pump installation is to be obtained in insurance rate structures.

We recommend you contact either the local insurance rating organization or the National Board of Fire Underwriters, 85 John St., N. Y. C.—B.A.McD.

Wireways

Q. *We have been asked to run a 4- by 6-inch wireway through the main room of a milk processing plant to contain motor feeders and control conductors for a new milk packaging machine. Is it not true that the code will prohibit the use of a wireway in a building of this type regardless of whether it is mounted on a side wall or the ceiling of the building?*—M.G.

A. Under Section 3622 of the National Code, you will note that wireways may be used only for exposed work in dry locations. Then under Section 3464 of the code you will note a reference to a dairy as a wet location. Therefore, you are correct in your assumption that a wireway cannot be used through the processing room where milk is processed and packaged. This will make it necessary to use either rigid metal conduit, electric metallic tubing, waterproof wiring of the non-metallic type or the new MI type of wiring material. —G.R.

Non-Metallic Sheathed Cable

Q. *Would appreciate your opinion on method of wiring with Romex, in residential frame houses (new construction).*

Is there any restriction in the Code on horizontal runs in 2- by 4-stud partitions or walls? If so, what are they?—C.W.R.

A. Romex is a trade name for the general Code terminology, non-metallic sheathed cable. The Code rules are covered in Article 336 and it will be noted that this method of wiring is permitted for all residential wiring.

Only eight prohibitions are listed for its use (see Section 3362c).

In running through studs, joists or rafters, Section 3010 applies. The cable must be run:

a. in holes at the approximate center of the wood member, or

b. in holes at least 2 inches from the nearest edge.

The cable may be run in notches in the edge of the wood members, if this does not weaken the member and if a ⅛-inch steel plate is used to cover the cable in the notch.—B.Z.S.

Pin-Plug Connectors—Stage Equipment

Q. *For a high school stage lighting job "slip connectors" (see any stage lighting cat.) were supplied for the spot lights that are to be clamped to the overhead stage pipes and same for those to be hung from auditorium ceiling in front of stage.*

1—Are connectors of this type required for these locations?

2—Can common straight blade cord connectors be used on small portable lights set around the stage for accenting?

Please cite the section in N.E.C. that would influence above.—E.R.

A. Section 5255 of the Code is a requirement covering connectors for flexible conductors which supply portable stage equipment. This provision merely requires such connectors to be so constructed that tension on the cord or cable will not be transmitted to the connections and that the female half of the connector shall be attached to the live end of the cord.

Section 5252 primarily concerns brackets on scenery but the wording implies that other fixtures are involved. This requirement calls for the use of

an *approved type stage connector to* be located within 18 inches of the fixture. While the application of this provision to the case you have presented might be questioned, the principle of safety involved with the use of the proper type of connector appears to be concerned with both applications.

The Underwriters' Laboratories list many cord connectors of the ordinary type which might satisfy the requirements of Section 5255. They also list cord connectors approved for stage use and all connectors so approved are of the pin-plug type.

In the case which you have presented, spotlights are clamped to an overhead batten which extends across the stage. This method of stage lighting eliminates the use of approved borderlight assemblies and unless it is properly wired with respect to abnormal use of cable or cord, it presents a hazard more serious than that presented by the type of connector used. While you do not cover this feature of the installation in your question, it is my opinion where long runs of cables are used to supply the spotlights there is a violation of Section 5211, which limits the use of portable cables only when fixed wiring methods are impracticable. It is my opinion than such an assembly of spotlights should be served through conductors installed in a metal wireway which is clamped to the pipe batten and provided with pin-plug stage type connectors attached to 18 in. of cable for the purpose of connecting each individual spotlight. In support of this contention, I refer to Code Sections 5211 and 5252.

The design of pin-plug connectors incorporates features which are not common to ordinary connectors and are exposed to conditions of use not ordinarily faced in other occupancies. On the stage of a theater, where both the fire and personal injury hazards are so prominent and where the security of the audience is involved, I believe that an investment in the safest type of equipment is more than warranted.

In answer to the second question, it appears to me that the requirements of Section 5252 which covers the requirements for brackets or fixtures on scenery of low wattage capacities would equally apply to portable lights set around the stage. It appears obvious that the hazard presented in either case would be practically the same and the necessity for the use of approved type stage connectors would likewise prevail in either case.

While the Code may not specifically cover every possible application that may arise, it does indicate the hazard involved and the method of safeguard-

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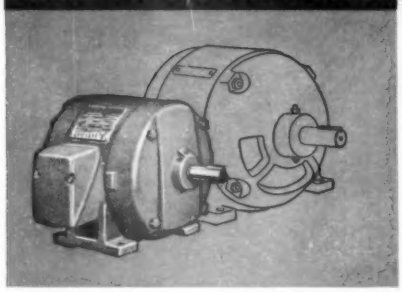

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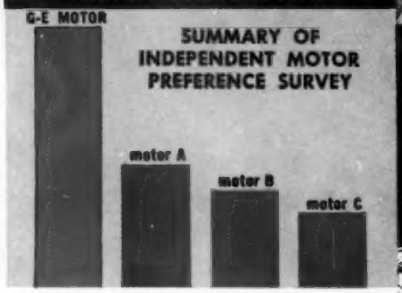

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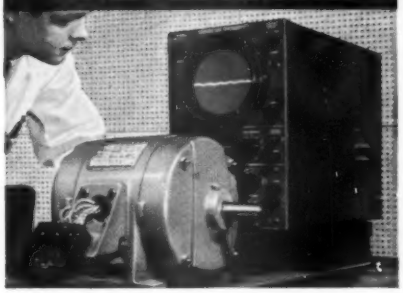

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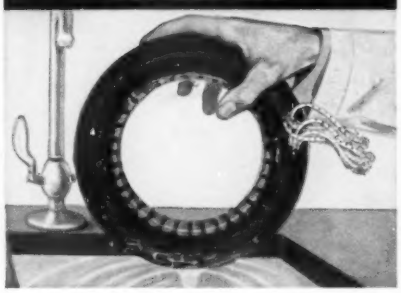

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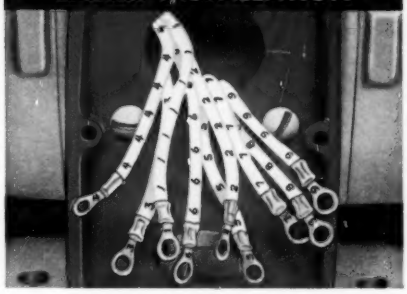

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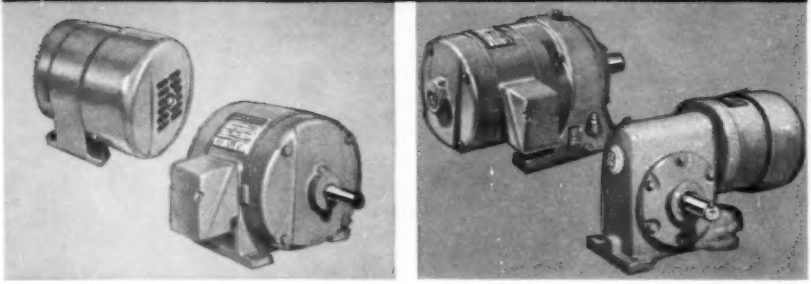

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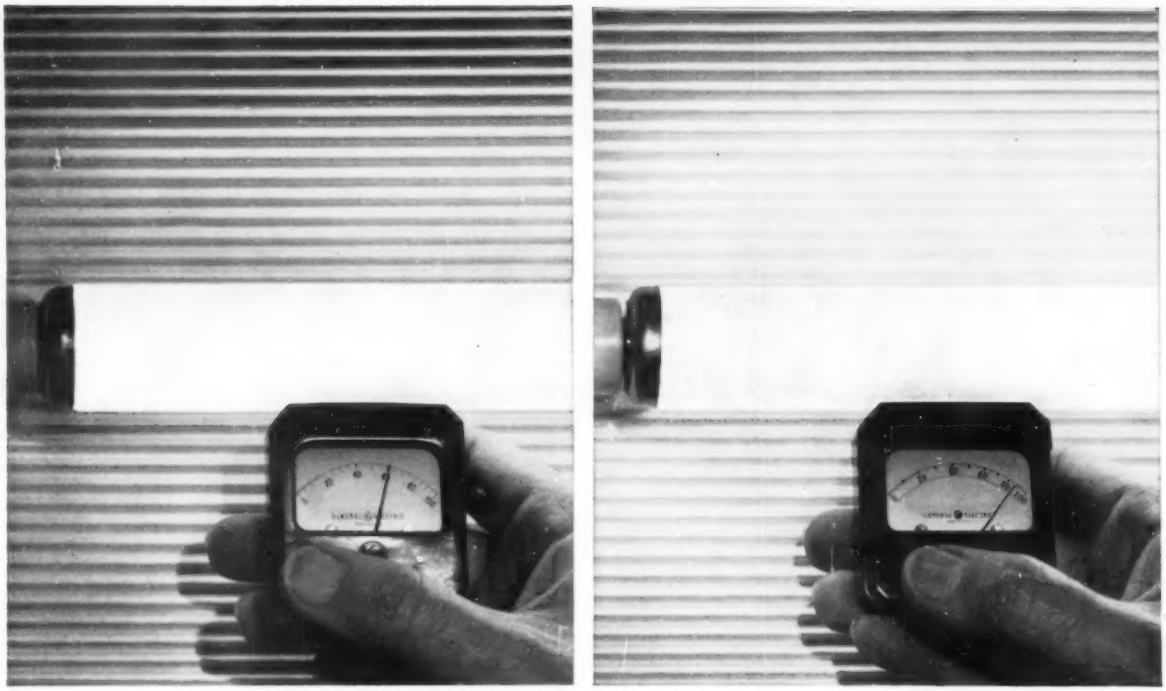

Regular slimline, left, gives 620 units of light. New High Output Rapid Start lamp, right, gives 840 units of light.

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ing same. It therefore becomes the responsibility of the authority enforcing the Code to see that the fundamental objectives are satisfied especially when the specific application is not covered by the Code—B.A.McD.

Time Delay Fuses

Q. *Is there any National Electrical Code ruling on the use of Fusetron plugs and cartridge fuses?*

Must the ampere rating of fuses exceed the size of wire as the ruling goes, because it permits power circuits sometimes to exceed the capacity of the wire, and is there a service factor of 1.25 amps as some motors are rated?—V.S.

A. Section 4346 refers to these fuses with time delay characteristics. It should be noted that this section does not specify the size to be used but makes a general statement as to the size, i.e., ". . . . fuse holders of smaller size than specified in Table 20 may be used."

In some cases the Fusetron may be rated as small as 100% of the motor full load current rating. In general about 125% is used for the rating of the Fusetron overcurrent protection.

Manufacturer data shows the size of Fusetron which may be used to give motor running protection and at the same time has "time delay appropriate for the starting characteristics of the motor."

For example a 15-amp motor (column 1, Table 20, Chapter 10) shows a maximum size of branch circuit overcurrent device of 45 amps (column 7 of this same table). This would require a 60-amp fuseholder (fused disconnect in this case). Using a Fusetron, the maximum size required would be a 20-amp size, and this could be placed in a 30-amp block.—B.Z.S.

Wiring "Split Level" Dwellings

Q. *A contractor in this city is erecting a number of homes in which he is placing one- and two-car garages slightly below grade level which are in direct communication down a short flight of steps to the basement. These are known as "split level" dwellings in which the bedroom section is up four or five steps above the living room and kitchen with the basement being below the daytime section of the dwelling. The garage floor in these homes will be from 18 inches to 3 feet below outside grade level. Does the Code actually prohibit the location of electric motors for the ventilating system on the floor of such a basement?—M.G.*

A. Under Section 5110 of the Code, you will note under paragraph c. that where a garage in a residence is located below the adjacent ground or driveway level, it is necessary to consider the entire area of the garage and of any enclosed space which includes the garage as a Class 1, Division 2 location up to a level 18 inches above the garage floor. All electrical equipment and wiring within such a location shall conform to the applicable provisions of Sections 5011 to 5026 inclusive of Article 500. In this same section you will note that adjacent areas in which hazardous vapors or gases are not likely to be released that have floors elevated at least 18 inches above the garage floor or that are separated therefrom by tight curbs or partitions at least 18 inches high, shall not be classed as hazardous. Therefore, in your instance, as the basement section is directly communicating by a short flight of steps from the garage, it must be considered an adjacent area unless cut off from the garage proper by a curb or partition which is at least 18 inches above the garage floor level. Technically, this would apply to even a one-car garage. Therefore, all electrical equipment located in the basement communicating with this garage would have to be 18 inches above the level of the garage floor unless it were of the type suitable for use in a Class 1, Division 2 location.—G.R.

Service Cable As Feeder

Q. *Is the following installation permitted:*

A 230-volt, 30-amp, 3-wire, 2-fuse cabinet connected in parallel with a 230-volt, 30-amp 2-pole fused safety switch for a 1600-watt water heater?

From the fuse cabinet 3-wire No. 8 service entrance cable runs about 25 ft. along the basement rafters before going through the wall to a 3-pole, 30-amp, 230-volt weatherproof entrance switch mounted adjacent to the meter outside the house.—C.J.

A. In the absence of all details involved with the installation, comment is given only on the features which appear clear and significant. It seems from your description that the No. 8 service entrance cable, which I assume has a bare neutral grounded conductor, runs inside the building wall, a distance of about 25 feet from the fuse cabinet to a service switch located on the outside wall of the building. In other words, the service to the property ends at the service switch and the service entrance cable with a bare neutral is being used as a feeder to supply a panel located in the building. Such procedure would be in violation of Section 3382 of the Code unless all of the conductors of the cable were fully insulated.

If the installation is new, there is a question which concerns the rating of the service switch. Section 2357 requires, in general, that it have a minimum rating of 60 amps. Section 2304 also may be involved, since under certain conditions a minimum No. 6 service is required.

The fuse panel and the heater switch may be connected in parallel provided all rules are satisfied. On a new installation however it is considered good practice to install a panel with spare circuits so that it is not necessary to keep adding additional switches or circuits as new loads are added.—B.A.McD.

Table 25

Q. *I enjoyed very much your explanation of Table 25 of the 1953 NEC; however, there are one or two items which are still hazy in my mind and I am wondering if you can clear them up.*

First of all, in your hypothetical case you mention that the compressor motor is rated 7½ hp. According to Section 4304b we find that nameplates on hermetic type refrigeration compressor motors need not contain hp rating. We also find that the manufacturers of this type of equipment follow this pretty closely in that none of our equipment is so marked. The only inkling we have in regard to the hp rating of these compressors is a more or less rule-of-thumb method of rating one hp for each ton of refrigeration. Whether or not this method is accurate or whether it can be utilized in gaining information necessary to use Table 25, I do not know. Perhaps you can clear this up.

Also in selecting the main disconnecting means, I notice that you use a factor of three which you multiply by your full load current in order to obtain the necessary size switch or circuit breaker to be used as a main disconnect. Where this factor of three is obtained is still a mystery to me. The size of overcurrent protective devices for motor branch circuits we have always found in Table 20. Will you explain where you obtain this factor of three, which I assume is supposed to assimilate the in-rush current?—T.P.McG.

A. As indicated in my previous discussion of Table 25, the use of this Table will create many problems for the designing engineer, the contractor and the inspector. The use of Table 25 presupposes that all the information required for its application will be forthcoming.

We are not actually interested in the hp rating. I only used the hp rating to illustrate the point that this rating does not have too much of a bearing on the designing of the electrical system. The actual full load current is the desired information and really the only information which will lend itself towards correctly designing the electrical system. The rule-of-thumb of 1-hp per ton of refrigeration is a pretty good one but as pointed out the hp rating does not have any bearing on the final size of overcurrent protection, branch circuit size, controller or disconnect rating. That is to say the nameplate hp rating would not mean a thing unless it gave a value which would correspond to that obtained in Table 25.

I did use the value of three times full load current for the maximum disconnect size. Actually the values shown in Table 26 or 27 would be used. It should be noted that Table 26 shows a 300% maximum motor branch circuit protective device only when fuses are used on ac, single and polyphase squirrel cage or synchronous motors with full voltage or resistance or reactance starters and with Code letters F to V. Table 27 shows two cases for using the 300% value.

Table 20 can be used but shows values for only specific cases of Tables 26 and 27. Thus for example a 20-amp motor shows 300% (60 amps) in column 7, 250% (50 amps) in column 8, 200% (40 amps) in column 9 and 150% (30 amps) in column 10, corresponding to the values set up in the respective classes of motor types in Tables 26 and 27.—B.Z.S.

Plastic Conduit and Fittings

Q. *I hear that the next general revision of the National Electrical Code may contain a new Article in Chapter 3 covering "Non-Metallic Conduit" wiring methods and materials. It is also predicted that Chapter 5, Article 500 may be amended to permit the use of non-metallic or plastic conduit of the high impact rigid type in Division 2 hazardous areas.*

This type of wiring could be useful wherever corrosive conditions shorten the life of metal conduit and fittings. There is a definite need for such wiring on cooling towers, particularly on cooling towers in oil refineries and chemical plants where leaks in heat exchangers often result in the escape of hazardous gases at the cooling towers. In one such plant engineers are now seeking a source of supply for just two simple items of plastic equipment. With these and with plastic pipe now available, they propose to renew the lighting system on a cooling tower where rigid galvanized conduit and fittings ordinarily last less than four years. These engineers are seeking high impact plastic boxes with bottom, sides and ends ½ inch thick and strong enough to be drilled and tapped on the job for rigid plastic conduit. For ½-inch and ¾-inch conduit the boxes should be 1¾ in. deep and 1½ in. wide by 3½ in. long, inside dimensions. For 1-inch conduit the boxes should be ½ inch larger in all inside dimensions. These boxes should be provided with plastic covers strong enough to resist warping, perhaps ½ inch thick and provided with soft rubber gaskets, or the covers may be made of metal with full gaskets of soft rubber cemented to the covers to effectively isolate the covers from the wiring. Corner holes completely through the boxes and covers should be provided for No. 10 brass or stainless steel machine screws with standard removable nuts. For the present, standard metal vaportight lighting fixtures are to be used. Later, plastic vaportight fixtures may be available with metal guards effectively isolated from the wiring. These may be of the pendant type, but flanged types suitable for attachment to timber supports are preferable. No metal parts should be used except such items as can be easily replaced with a minimum amount of trouble.

On the initial installation all conduit and fittings larger than one inch and all switches and explosion-proof seals are to be located in areas with less corrosive conditions than exist on top of the cooling towers. Later it may be possible to obtain plastic 90° elbow fittings so that some 20 explosion-proof motors may be wired through 1½-in. plastic conduit.

At least two well known manufacturers of electrical wire and cable are now producing plastic pipe and fittings. These fittings include elbows and tees for pressure piping but no fittings have been designed for pulling and splicing wire.

Can you advise any immediate prospect for definite Code recognition of non-metallic conduits, such as the plastic version outlined, with suitable non-metallic fittings and boxes?—L.P.C.

A. The possibilities presented by the use of plastics for raceways, boxes and fittings should, in my opinion, give impetus to the recognition of a proposal concerning other types of non-metallic raceways which was considered for adoption in the 1953 Code. This proposal, which concerns fibre ducts and Transite, remains active on the docket of the NFPA Electrical Section and undoubtedly it will be considered by the Code-making panels concerned during the coming year and definite action taken before the next Code edition is published.

For several years Underwriters' Laboratories have listed fibre, Transite and soapstone conduit with pertinent fittings as approved for use underground or for central station wiring. As you may note, the recognition is restrictive and does not include general recognition for use as a wiring method. The U. L. also lists many manufacturers of junction and pull boxes, all of which are of metal construction. While the N. E. Code recognizes the use of fiber in the construction of underfloor raceways as covered by Article 354, it does not recognize a non-metallic conduit, such as fiber, Transite or plastic, for general use and provides no requirements for such installations such as we now have for metal conduit under Article 346. As a result, the proponent of the proposal mentioned above, proposes that a new wiring method be recognized by the Code under Chapter 3 covering Fibre and Transite Duct installations, and I would suspect that when the question is considered by the panel involved that it will be on the basis of any approved non-metallic conduit, not only fibre or Transite.

At the present time the N. E. Code recognizes, under Article 370, nonmetallic outlet boxes but restricts their use to knob-and-tube work, open wiring on insulators, non-metallic sheathed cable or non-metallic waterproof wiring. It therefore follows that any definite Code recognition of nonmetallic conduit as a wiring method will involve changes in Article 370.

I personally believe that the prospects for prompt recognition of nonmetallic conduit, with associated fittings and boxes, as a wiring method will depend upon the force of the argument presented in support of such a proposal and the facts brought out by the usual fact-finding report conducted by U. L. It is my experience in the growth of our electrical wiring industry that any new development of wiring techniques or devices that presents desirable features toward the promotion of safety will be readily recognized.—B.A.McD.

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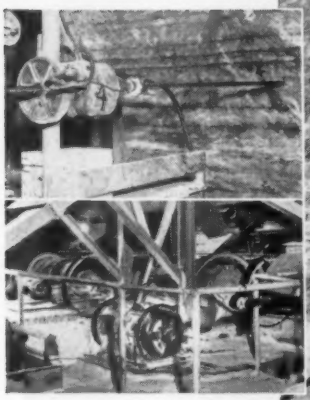

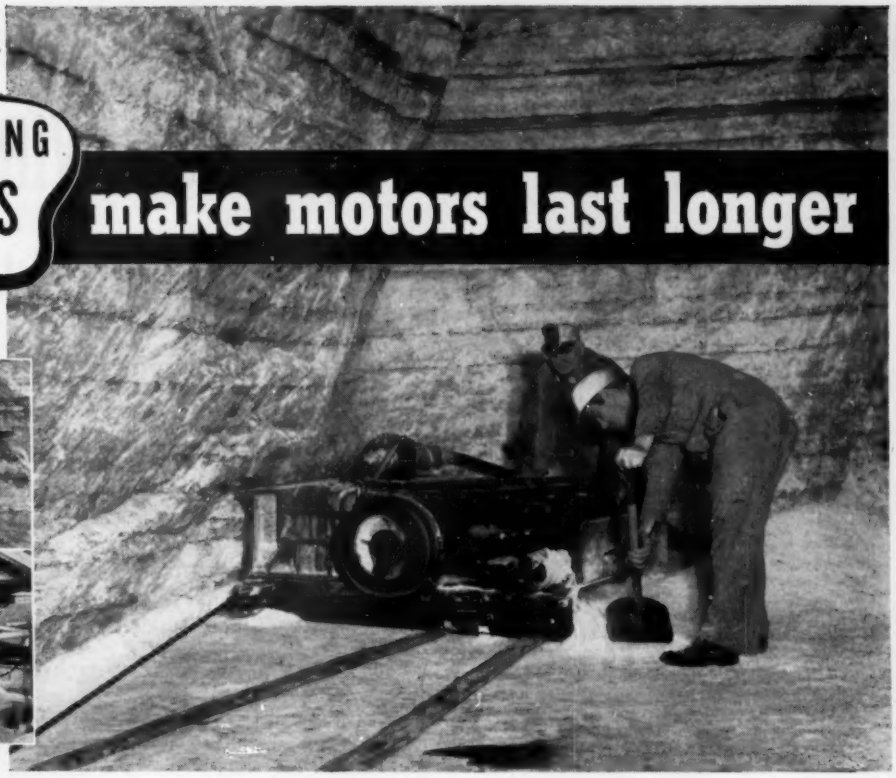

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Opinion

ADEQUATE WIRING

The Contractor is the Key

An informal interview with A-W pioneer W. E. Sprackling *by Editor W. T. Stuart*

W. E. Sprackling, executive vice president of Anaconda Wire and Cable Co. was the first Chairman of the National Adequate Wiring Bureau. His frank and challenging views on the present and future industry responsibilities for adequate wiring promotion are supported not only by keen insight into the current situation but are also disciplined by an exceptional understanding of the historical perspectives.

W.T.S.: Mr. Sprackling, you've been active in behalf of adequate wiring for a long time now—I believe you were the National Adequate Wiring Bureau's first Chairman, weren't you?

Mr. Sprackling: That's so. It was founded back in 1932. The NEMA group sponsored its foundation. It was financed by NEMA, too, but it was quickly encouraged and supported by all the industry.

W.T.S. Yes, and of course it started out with a definite program. Well now, as a pioneer in adequate wiring promotion, in your opinion what is new about this sudden flare-up in industry interest in the subject?

Mr. Sprackling: I wonder if there is anything new about it at all. For instance, what can anyone say today about adequate wiring that hasn't been said before, many times before? I'd say that the same voices you hear now are the voices you heard five, ten —even 25 years ago.

W.T.S.: Well, what makes them sound different now—more significant? Is it just that the passage of time has made prophets of all of us?

Mr. Sprackling: That's about it. The things we predicted would happen if adequate wiring wasn't promoted by *all* of us, have happened. What was once an annoyance has become a real problem—and it's growing all the time.

W.T.S.: So the difference today, is that more and more segments within the electrical industry are effected by inadequate wiring. Could you cite a case in point . . .?

• ***inadequacy is their biggest block***

Mr. Sprackling: Well, take the appliance manufacturers — they're vitally interested in adequate wiring nowadays. They've got to be; inadequacy is their biggest stumbling block to sales.

W.T.S.: You think, then, that the amount of wire needed to adequately wire a house isn't as material as the benefits the customer gains overall from the added capacity he buys?

Mr. Sprackling: Well, no, not quite that. Put it this way: We've reached the point where the potential of dollar sales of appliances is directly affected by adequacy of wiring. Obviously, the home or commercial building that was wired originally for lighting incandescent lamps can't possibly carry the load of modern lighting and electrical conveniences.

W.T.S.: And you make the point that when you do have adequate wiring there are all these secondary benefits.

Mr. Sprackling: Yes, and the secondary benefits are tremendous. Think of the benefits to utilities—in terms of the possible growth of residential load. Then as that growth continues, you get this tremendous potential for sales of every kind of product going

● *problem of every householder*

into generation, transmission and distribution of electric current.

W.T.S. Putting it in that way the field does seem limitless. Just about every company of every branch of the industry would be affected.

Mr. Sprackling: And not only the industry alone. The problem of inadequate wiring today is the problem of every householder who pushes a plug into an electrical outlet and is plunged into darkness. It's the problem of every electric utility that is called in the middle of the night because, as the householder puts it: "The power has failed." It's the problem of the serviceman who stops by and changes the fuse.

W.T.S.: Yes, and most of the time that's all he can do even though he knows he'll be stopping by again some other middle-of-the-night.

Mr. Sprackling: That's right—doesn't have the chance to sell a new adequate wiring job, just changes the fuse. And how about the appliance salesman who was told last summer: "This air-conditioner wouldn't work last night—take it back." That was a problem of inadequate wiring; certainly the manufacturer made it with the best craftsmanship he knew.

W.T.S.: You think then that the program we devised under the original NAWB in 1932 may not be enough—or rather, that it isn't suited for our present times and problems?

Mr. Sprackling: Something like that. Over the years the NAWB has done

ADEQUATE WIRING (continued)

a fine job, as good as its available funds would allow. But it can be strengthened; its usefulness can be expanded. Given the necessary authority, the tools and the funds to carry out the enlarged program the industry needs, I'm sure the NAWB could be equally successful in the future.

W.T.S.: Would you make some concrete suggestions on how NAWB can expand or improve to do a better job?

Mr. Sprackling: Well I—well, first let me say that none of us can be critical of the job the Bureau has done within the limits we set for it. It's been exceptional—and it gets better all the time.

But possibly we ought to open up a little, increase the scope and the influence of the Bureau. It may be a mistake, for instance, to have the National Adequate Wiring Bureau housed in one particular association. It may be a detriment because the other associations—the utilities, wholesalers, contractors,—might tend to be a little stand-offish.

W.T.S.: You mean that the Bureau's job is big enough now to be housed by itself and, possibly, run by an expanded committee representing the various associations,—is that it?

Mr. Sprackling: Yes, because naturally they would need to operate under some sort of direction. Now, of course, none of this is meant to detract from the work that the National Adequate Wiring Bureau has done under NEMA. They have done a good job as far as they could go. Now they can go a little further.

W.T.S.: I see. If NAWB were a separate entity—working under direction—you believe that the whole psychological viewpoint toward it, and toward its work, might be changed for the better?

Mr. Sprackling: I believe it would, yes. For instance, take the subject of its funds and the basis on which it gets them: The amount of money budgeted by NEMA for NAWB use is always the hardest thing to get across with members of the various sections of NEMA. I'm afraid we all tend to look at this money as *dues* —and somehow or other people seem to resent paying dues, though the money actually is benefiting them in a promotional way.

W.T.S.: You mean they thing of them in the same way they think of, say, taxes?

Mr. Sprackling: That's right. Now, if these same members could envisage these dues as money used for sales promotion work they can measure in actual sales return, why they'd be much more generous. . . .

W.T.S.: Now how would that work? For instance, how would it work with Anaconda?

Mr. Sprackling: Well, I think we would have to look at it as part of our company's sales promotion budget —put it right in with our advertising. Then the amount Anaconda pays into the NAWB would be insignificant alongside of our total advertising budget. And so, if I *could* go before my Board of Directors and picture these funds for NAWB as a sales *promotion* feature, rather than as dues, I'm fairly certain we could induce them to contribute generously to this enlarged Bureau. You see the psychology?

W.T.S.: I believe I do, yes. But you know, this enlarged NAWB would probably need a large staff, otherwise your sales promotional work wouldn't be too effective.

• *we could induce them to contribute*

Mr. Sprackling: That's certainly true, for one of the basic principles of promotional work—of selling itself—is not to advertise until you have representation in the field. Otherwise, while your advertising may create a desire for the product—well, there is nobody out there handy to go sell the benefits, or the product itself. In order to corral this market we would need to have representatives right out in the field who are promoting this whole adequate wiring campaign. Actually, you know, we in Anaconda realized this and have been doing it in a limited way—limited because we are but a single company. We have been holding meetings all over

• *we have been pretty successful*

the county with local utilities, distributors and contractors.

W.T.S.: And I understand with the F. H. A. and the banking people, too.

Mr. Sprackling: Yes, and if we do say it ourselves, at the risk of blowing our own horn a little, I'll say that we have been pretty successful. We have any number of letters from local groups saying that this has been the first successful approach of its kind.

W.T.S. From contractors, too, I imagine. So then, your thought is that some similar method of presenting this to the public should be taken on by the entire industry, not by one or two individual companies. How would you tie in the advertising programs of the different companies?

Mr. Sprackling: Through the efforts of the NAWB, of course. Think of the amount of advertising that is done today, wonderful advertising by people who are spending hundreds of thousands of dollars to sell the public on the single idea that they need their homes adequately wired to get the full benefit of electricity. And then again there are the editors like yourself, and on the other trade magazines, writing constantly on the subject—even the big news weeklies like Business Week, Nation's Business, as well as the picture-story mass media like Life, Look and others. And how about the ads that begin to appear sponsored by home insurance companies, the FHA itself, and the local banks—it must come to a staggering amount of money. Now why couldn't these same people contribute a like amount of money to the NAWB?

W.T.S.: That might be a hard idea to sell. They would probably object that they are losing their advantage of having their company's name connected with the advertising.

ADEQUATE WIRING (continued)

Mr. Sprackling: But do they need to lose that advantage? I don't think so. If this expanded, independent National Adequate Wiring Bureau were properly constituted, if they had the prestige and the manpower, they could go to these big national companies who are capable of doing a tremendous amount of advertising to the public and suggest that they could gain a great deal by pointing their advertising along lines laid out by the NAWB.

> **W.T.S.:** You mean it would still be their ad, that it would still carry their message and their company name; they'd still get full advantage from the money they spend in promoting this effort?

Mr. Sprackling: Exactly. Then, for the first time, you would have national advertising coordinated. You would have an industry Bureau that would go out into the field and show local groups how they themselves might proceed with their grass roots promotion because that is where the orders are going to be placed. You've got to go to the fellow who is in direct touch with the home owner or the commercial establishment—and that is the local contractor. You've got to build up his part in the job.

> **W.T.S.:** You think the local contractor is the important cog in the whole works?

Mr. Sprackling: Yes, he is the contact man. Of course the contractors recognize that themselves and NECA has an advertising and promotional campaign.

> **W.T.S.:** Yes. Such programs are also important in that they encourage contractors to use sales promotion.

Mr. Sprackling: Yes, an association can only advertise and promote, like Anaconda and other manufacturers. When you come right down to it, though, someone has to go out in the field and demonstrate how to do it. We've got to have "missionaries" available to help contractors in more direct ways *right on their home grounds.* Once a contractor understands a program and its benefits *to him,* once he is sold on it, there is no holding him down.

> **W.T.S.:** You think, then, that contractors are the key men?

Mr. Sprackling: I'd put it stronger than that: Without the contractors' cooperation the whole adequate wiring program could fail. If contractors don't understand the program, or if they don't approve of it, or if they are indifferent about it, it will never

take hold to its full potential.

W.T.S.: You mean that no matter how ambitious the planning, and no matter how much we spend in our advertising to "take the program to the country", the whole approach must be practical or it won't appeal to contractors?

Mr. Sprackling: Yes, that's it exactly. Without their grass-roots support we'll never get to first base.

W.T.S.: Getting back for a moment to your conception of an enlarged, independently-housed National Adequate Wiring Bureau: You said its activities and the scope of its enlarged influence would need to be guided by a committee chosen from the industry itself. What sort of committee?

● *everyone must except his share*

Mr. Sprackling: That's an easy one. Each branch of the electrical industry would need to be represented.

W.T.S.: What about the men themselves? What executive level would they be from?

Mr. Sprackling: I'm not sure that would matter too much. Preferably, the committee should be composed of men with a reputation for "getting things done."

W.T.S.: And based on the capacities of individual companies and organizations, these men would decide what would be the contribution of each branch of the industry—is that it?

Mr. Sprackling: Right. Everyone must accept his fair share of the work-program. There is no one in the whole electrical industry who isn't affected—all the way from generation to end use, whether lighting, heating, appliances or apparatus.

W.T.S.: But even then, isn't it a long haul from the program on paper to the actual efforts of those who must carry out the program?

Mr. Sprackling: It is, yes—and nobody knows what a long haul it is better than we at Anaconda. As I said before, without enthusiastic grass-roots

ADEQUATE WIRING (continued)

support, nothing worthwhile ever was accomplished, or ever achieved permanence.

W.T.S.: You're coming back again to the electrical contractor.

Mr. Sprackling: You always come back to the contractor. He is central to the whole idea of adequate wiring.

W.T.S.: But you think that all of us need a little more selling of this idea to ourselves before we can venture out, all together, to sell the country.

Mr. Sprackling: That certainly is true. We've all got to become successful salesmen, for the electrical industry as other industries have made successful salesmen and successful propagandists, of the men who make their livelihoods in them.

W.T.S.; But won't all this come in time anyway?

Mr. Sprackling: Probably it will. But it may be later than we think. I'm afraid that if we don't arrive soon at some grass-roots organization of our efforts that the situation seems to demand, one day we'll be faced with a problem in public relations that will take a lot more planning and effort from each of us, for a much longer time, than if we were working right now, together.

W.T.S.: With all the wheels moving in the one direction—I see what you mean. Now, if I may summarize, you believe that the present NAWB activities need substantially larger support in money and manpower, and that all parts of the industry should take its share of work under the new NAWB's program. You believe that parallel activities by individual companies or organizations —like advertising, sales promotion, merchandising—all are beneficial and companies and groups can retain their individuality even while they help promote the NAWB "message". You believe that the contractor is the key to everything, and that industry activities should give closer attention to his particular needs and problems.

Mr. Sprackling: Yes, I think that points it up — with one further thought: With all the national advertising, with all the promotional work, when you come right down to it, it's the contractor himself—the man out in the field—whose bread and butter depends upon the amount of business he brings in from day to day—he's the man who motivates this whole program. He's the man we all depend upon to help us keep the program alive and moving toward success. With his active cooperation we can't help but be successful.

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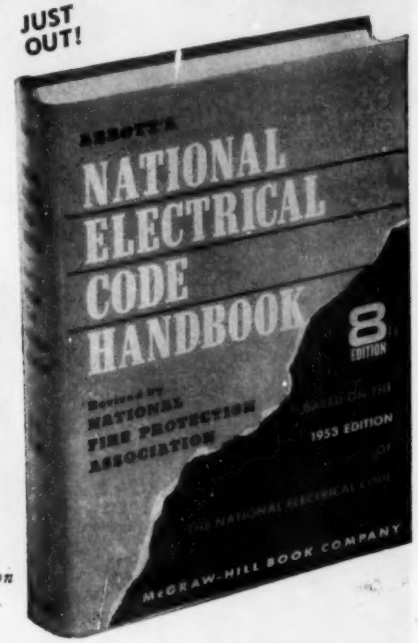

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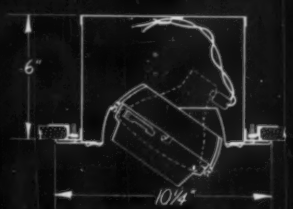

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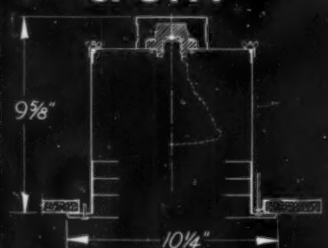

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In The News

Prospects Bright for Florida Contractors

Development of better industry practices and trade relations looking toward a fast growing electrical market was the theme of a hard-working week-end convention, October 15-17, of the vigorous new Florida Electrical Contractors Association. Over 350 members and guests converged on mid-state Orlando for a combined business meeting and trade show of the organization which, though only a little more than a year old, is already attracting nationwide attention for its constructive and forthright approach to industry problems.

President V. L. Burkhardt of West Palm Beach reviewed the growth and accomplishments of the past year's association activities which have included open panel discussion with representatives of suppliers and manufacturers aimed, under a strict "no personalities" rule, at a better mutual understanding of the problems and responsibilities of each group.

Howard Palmer, of Orlando, reported on a highly successful campaign for better electrical plans and specifications. Members were encouraged to return poor or inadequate plans to architects. He said that reactions were prompt and resulted in a series of local conference meetings with architects where the suggestions of the contractors for improving electrical plans and specifications not only were carefully considered but welcomed by the architects.

James Dandelake, president, Miller Electric of Florida, Jacksonville, discussing better relations between electrical contractors, distributors and manufacturers, urged the contractors to observe the same responsible policies with respect to their suppliers as they would wish from architects and general contractors in the handling of electrical bids. He also charted the dollar-and-cents savings which resulted from a rigorous job safety program, citing a multimillion man-hours project with lost-time injuries far below industry averages and without a single fatality.

Carl Boester, Director of Housing Research, Purdue University Foundation, Lafayette, Indiana, proposed a high capacity, low cost, wiring method based upon a closed loop, three wire, feeder ring with overcurrent protective devices at each outlet. Use of the closed loop, it was stated, would provide up to 9600-watt capacity on 3 No. 12 conductors.

OFFICERS named at Orlando convention of Florida Electrical Contractors Association are (left to right): V. L. Burkhardt, West Palm Beach, retiring president; Axel O. Ornberg, Orlando, president; Howard Palmer, Orlando, first vice president; R. H. Palmer, Lake Worth, second vice president; L. L. Dick, Tampa, state manager.

W. T. Stuart, Editor, and B. C. Cooper, Eastern Editor of *Electrical Construction and Maintenance* keynoted the meeting with an illustrated presentation on "What's in Our Future". They reviewed a series of charts and photos of recent electrical installations extracting the clues of future trends and opportunities for electrical contractors.

New officers appointed and installed October 16 were: president, Axel O. Ornberg, Curry Electric Co., Orlando; first vice president, R. H. Palmer, Jr., Lake Worth; secretary-treasurer, Howard A. Lilly, Tampa; state manager, L. L. Dick, Tampa. The Board of Directors consists of one director from each chapter, as follows: J. Arthur Turner, Sr., Tampa; Clifton W. Whitmore, Sr., Miami; J. K. Scarborough, Ocala; E. T. Brantley, Clermont; Fred S. Shinn, Lakeland; W. S. Stewart, Bradenton; Jim Baroca, Pensacola; James R. Boyett, Fort Myers; Seals Fagan, Lake Worth; Rudy Baacke, Jacksonville; Gene Guffy, Fort Lauderdale; Sam Grant, St. Petersburg; and Marion M. Harrison, Panama City.

New Jersey Electrical Leagues Meet

Members of the New Jersey Council of Electrical Leagues attending the organization's 18th Convention on October 15 and 16 in Atlantic City, New Jersey, heard two speakers stress the importance of cooperation between all segments of the industry in combating the evils of inadequate wiring.

O. B. Falls, manager of Utility Sales at General Electric's Apparatus Sales Division in Schenectady, New York, spoke optimistically about the future of the electrical industry, citing a G. E. prediction that total sales of electrical energy would increase by more than 100% in the next ten years. The 1954 average residential load of 2500 kwhrs per customer is expected to double by 1964, he said, due to a great extent to anticipated success of such new appliances as wall-mounted refrigerators and combination water heater-conditioners, as well as advances in television, food freezers, washers, dryers and home lighting.

However, he pointed out that this confidence assumes that the present problem of inadequate wiring would be tackled jointly by those most affected: contractors, maintenance engineers, utilities, dealers and wholesalers, and manufacturers. He advocated an elevation of specification standards, such as an established 3-wire, 120/240-volt, single-phase service entrance rated at 100 or even 200 amperes, plus

particular effort directed at the development of new products and methods to facilitate rewiring.

Willie Mae Rogers, director of the Good Housekeeping Institute, projected the question "What does a homemaker expect of the electrical industry?" and had two ready answers: improved service from manufacturers, and adequate wiring at more reasonable rates.

She claimed that homemakers want better treatment, service-wise, than they are getting. Repair services and warranties, she said, have long been the argument used to support buying at list price; however, it is a weak crutch when dealers who are giving good service are in the minority, and the customer feels he'll have to battle for his service rights anyway.

Miss Rogers' mail shows a great deal of confusion in the mind of the homemaker with regard to adequate wiring. When six electrical appliances are to be plugged into a system able to accommodate only two, *which four shouldn't have been sold to him by the manufacturer?* she asked. Obviously, there's an educational job to be done both among customers and in the industry, she added.

Prior to the business session, members of the League re-elected all previous officers for the coming year. They are: president—John T. Plaskett, John T. Plaskett & Sons, Merchantville, N. J.; 1st vice president—William Griffith, Griffith Electric Supply Co., Trenton; 2nd vice president—Oscar Wells, Jersey Central Power and Light Co., Asbury Park; secretary—Charles E. Beck, Beck Electric Co., Riverside; treasurer—David Sarbone, president, Atlantic Electric Distributors, Inc., Hackensack; executive committeemen—H. J. Hanbury, Westinghouse Lamp Div., Bloomfield, Clifford Justesen, National Electric Supply Co., Passaic, and J. H. Stapleton, Public Service Electric and Gas Co., Newark.

Eastern and Western Sections of IAEI Hold Conferences

The Eastern Section of the International Association of Electrical Inspectors held its 30th annual meeting in Atlantic City, N. J., August 30—September 1, 1954. Registration was in excess of 350, for the best attendance on record.

Two main themes carried throughout this meeting. One was the Light's Diamond Jubilee, which Atlantic City has been celebrating during the summer season, with special lighting displays on the boardwalk and major thoroughfares. The other was National Electrical Week, being sponsored by the IAEI for the first time this year, to be observed during the week of October 18-24th.

The 30th annual meeting was opened by J. D. Lynett, chairman of the Annual Meeting Committee. Also on the morning program were the report and address of Eastern Section President Mattfield and the presidential address of B. A. McDonald, President of IAEI.

The first afternoon session was devoted to five feature talks in addition to Code and floor discusions on general subjects. First speaker was B. L. England, President, Atlantic City Electric Company, who talked on "Adequate Wiring—Whose Responsibility?"

"Growth Problems of Room Air Conditioners" was the title of a talk given by George S. Jones, Jr., managing director of the Air Conditioning & Refrigeration Institute. The problems already created require some very serious thought and study by manufacturers of these conditioners, electric utilities, electrical contractors and inspectors, he said, discussing some of these problems in detail.

J. W. Anderson, general superintendent with the Philadelphia Electric Company's Transmission Distribution Department, discussed "Electric Service for Air Conditioning Loads", and outlined some of the problems faced by the utilities as a result of the rapid growth of air conditioning.

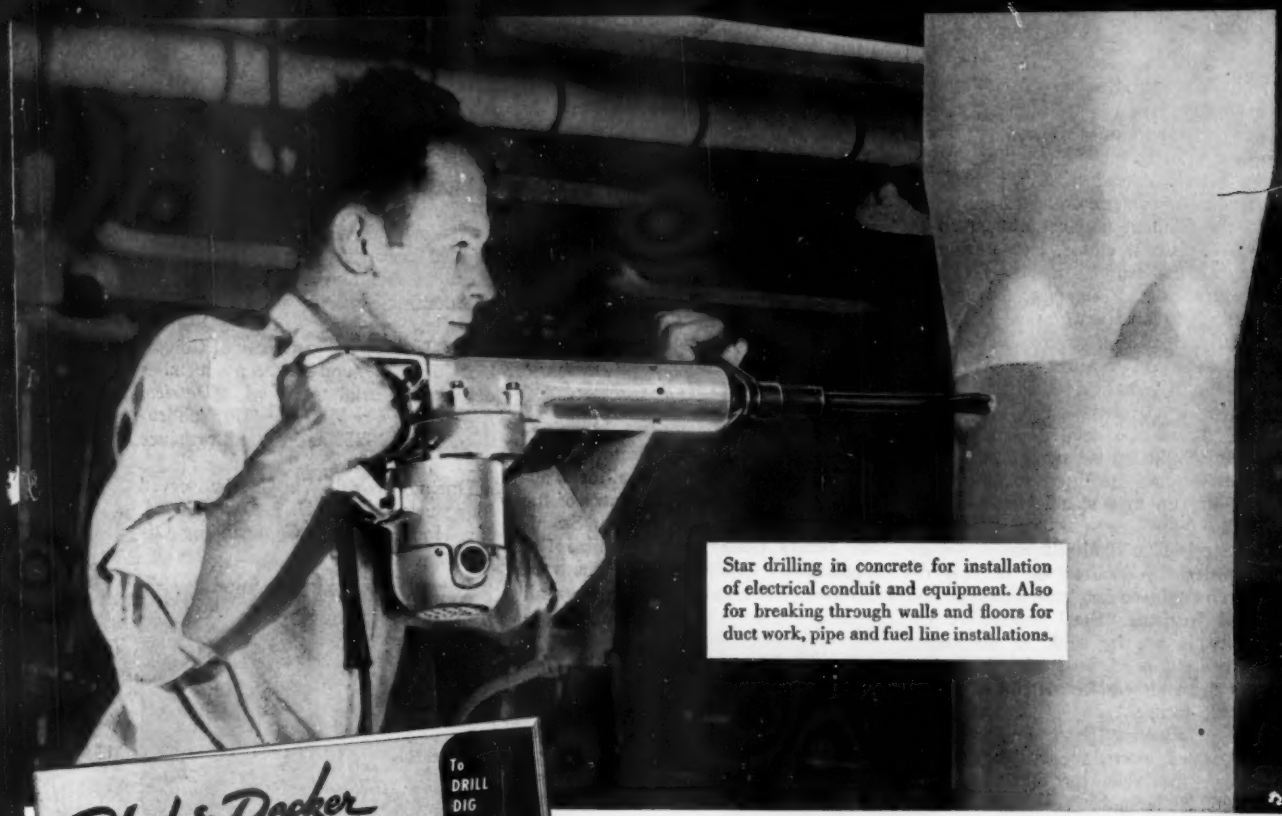
Sam J. Rosch, consulting cable engineer with Anaconda Wire & Cable Company, told the group about "Some Trends in the Electrical Industry of Tomorrow".

R. F. Lawrence, Westinghouse electrical engineer from Pittsburgh, discussed "Engineering Advantages of High Voltage Distribution."

Joseph Covington, manager of the Adequate Wiring Bureau for Consolidated Edison Company of New York, Inc., told of surveys conducted in New York City on adequate wiring in homes and apartment buildings.

CODE problems and Hurricane Carol shared the spotlight with inspectors at the 30th annual meeting of IAEI, Eastern Section, Atlantic City, as they "sit it out" between sessions. L. to r. are: B. B. Whelan, Chief Electrical Inspector, Boston; John W. Hager, Asst. Supt. of Inspection, New York City; Carl J. Dane, Bussmann Mfg. Co., Winchester, Mass.; George W. Hilton, UL, Inc., Boston and Chicago; and R. L. Reid, Inspector, Arlington, Mass.

NEW YORKERS attending the annual meeting of the Eastern Section, IAEI, in Atlantic City August 30-Sept. 1, 1954 included (l. to r.): Steven M. Brown, ABC Maintenance Co.; Anthony Angelo, Borough Chief Inspector; Walter De Soto, Electrical Inspector; and F. Marcellino, Chief Inspector, Borough of Manhattan—all of New York City.



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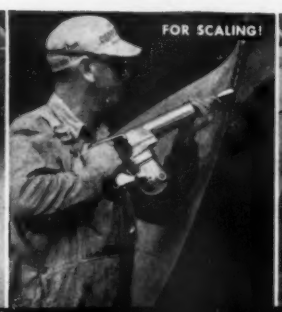

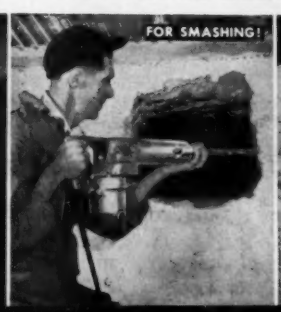

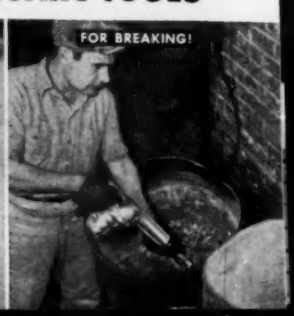

giving statistics, and outlined his company's promotion program for Adequate Wiring.

"What's Ahead in Electrical Construction" was presented to the group in the form of a panel discussion by W. T. Stuart, editor, and Berlon C. Cooper, Eastern editor, *Electrical Construction and Maintenance*. The continuing growth of new building construction and greater activity in modernization assures a continued growth of electrical construction and electrical maintenance, they pointed out. Areas of special growth activity include lighting, air conditioning, and electric space heating, which is fast building up to a sizable market, they said.

"Steel Electrical Raceways" were discussed by Walter O. Zervas, research engineer for American Iron and Steel Institute. Steel production capacity is up, he said, in discussing today's status of the steel industry, so that demands can be met for the foreseeable future.

The following Eastern section officers were elected: president—A. O. Hyde: first vice president—W. M. Carroll; second vice president—George H. Schardien: third vice president—John W. Hager; and secretary-treasurer—J. W. Kind. The Executive Committee consists of the officers and C. A. Berlepsch, J. W. Canada, Howard A. Brown, B. F. Greene, J. D. Lynett, Frank Stetka, B. B. Whelan, A. Angelo, and J. D. O'Connell.

"Safety you Can't Forget" was presented by C. A. Biddulph, Eastern Division Manager, the Thomas & Betts Company, and "New Wiring Connector Methods" were described by S. N. Buchanan, President, Buck Electrical Manufacturing Company.

Western Section

Inadequate wiring and its effect on electrical safety, efficient application of modern appliances and industry sales was the general theme at the Golden Anniversary Convention of the Western Section, International Association of Electrical Inspectors last month. More than 500 inspectors, contractors, and guests met at the Hotel Seelbach in Louisville, Ky., Oct. 11-13 to hear prominent industry speakers review national problems and to exchange experiences gained in local areas.

International president, B. A. McDonald, Rochester, N. Y., told the convention that Light's Diamond Jubilee and National Electrical Week are the two outstanding electrical events of the year 1954. Among IAEI objectives Mr. McDonald proposed the following:

Promote increase in electrical inspection forces and more re-inspection to reduce fire losses due to electrical causes. Most of these are attributed to NEC violations and uninspected installations.

Recognize the interdependence of all phases of the electrical industry to foster better, safer electrical installation. Maintain criticism on a constructive basis.

Growth in the use of room air conditioners is definitely held back by inadequate wiring, H. G. Strong, executive secretary, Refrigeration Industry Safety Advisory Committee, Washington, D. C., told the inspectors. This committee advocates the uniform acceptance throughout the country of the latest edition of the American Standard Safety Code for Mechanical Refrigeration (ASA-B9-1) plus the National Electrical Code to govern all electrical materials, design, workmanship and inspection, he noted.

R. W. Wilson, Kentucky Utilities Company, Lexington, pursued the theme of inadequate wiring by noting that everyone in the electrical industry suffers when no circuit exists for an appliance.

A full day was devoted to code panel reports and open forum discussion of code problems and questions under the guidance of C. M. Park and J. E. Fisher. Inspectors and contractors present had an opportunity to get solutions to their specific problems from nationally recognized code experts. A good majority of inspectors at the session voted against a suggestion to permit installation of vertical feeder busways in hoistways (one method of getting additional feeder capacity in office buildings). The use of pre-cast concrete core (Flexicore) floor and ceiling as a raceway was discussed at some length. It has not been approved by U. L. as yet as a raceway and experience with a few installations in this country has led to electrical inspector dissatisfaction, the discussion revealed.

At the concluding business session the following Western Section officers were elected: president—J. E. Fisher, Elkhart, Indiana; first vice president—Glenn Rowell, Minneapolis, Minn.; second vice president—Robert Thompson, Albuquerque, N. M.; secretary-treasurer—H. L. Parks, Charleston, W. Va. Newly elected members of the executive committee include: L. S. Crain, Ralph Moore, Charles Kenig, E. H. Rueppel, Theodore Briegel and Robert Owen. Representatives on the executive council, IAEI include: S. R. Todd, Chicago; O. E. Radtke and G. C. Monroe, Springfield, Mo.

Between convention sessions, delegates visited an interesting display of new electrical products.

Arthur W. Hooper Named NAED Executive Director

Arthur W. Hooper has been appointed executive director of the National Association of Electrical Distributors. He succeeds the late Charles G. Pyle.

Mr. Hooper is a graduate of Columbia University, and has been a member of the editorial staff of *Electrical Wholesaling*, a McGraw-Hill Publication, since 1945, and its editor since 1951.

During World War II, he served four years with the U. S. Coast Guard. Mr. Hooper became Commanding Officer of a Sub Chaser with the rank of Lieutenant. He saw service in the Atlantic and Pacific theatres and concluded his military service as officer in charge of a repair base for small boats in the Philippine Islands.

ARTHUR W. HOOPER

Mr. Hooper was associated with the Fitzgerald Publishing Co., a division of the Walter H. Baker Play Publishing Co., before he joined *Electrical Wholesaling*.

His intimate association with the electrical distributing industry during the past eight years has allowed him to make a close study of the economic considerations and sales procedures for marketing products through distributors. As the Executive Director of the NAED, Mr. Hooper will manage an organization with an active membership of over 1100 houses. The Association represents the electrical distributing industry, which is responsible for a vast proportion of the nation's annual sales volume of electrical construction materials and appliances—almost six billion dollars.

NEW CHIEF INSPECTOR of the self-supporting North Dakota State Board of Electricity is former Board member George Yineman of Bismarck. Yineman has his 21-inspector force cracking down on illegal contracting activities of unlicensed persons and is promoting a new rural electric reinspection program involving the active cooperation of insurance companies and the farmers.

NISA News

William M. Hogue, past-president NISA, General Convention Chairman in 1955 and partner in Larsen-Hogue Electric Co., Los Angeles, is a director of the Rotary Club of Lynwood, Calif.

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The Annual Southeastern Chapter Conference was held October 7-9 at the Tampa Terrace Hotel in Tampa, Fla. The meeting, always one of NISA's major chapter events, began with registration on October 7 and a president's reception and cocktail party that evening. Meetings were held on Friday and Saturday mornings, October 8 and 9, with Friday afternoon set aside for local shop visits and Saturday afternoon for recreation.

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The general chairman of NISA's 1955 Convention, to be held June 6-10 at the Hotel Statler in Los Angeles, is past-president William M. Hogue, Larsen-Hogue Electric Co., Los Angeles. He will be assisted by eight committees, the chairmen of which are as follows:

Program Committee—George Larsen, Larsen-Hogue Electric Co., Los Angeles.

Special Events Committee—Russell C. Lockard, Lockard Motor & Pump Co., Huntington Park, Calif.

Transportation Committee—William Pompey, Pompey Electric Motor Service, Pasadena, Calif.

Promotion Committee — Joseph Walta, Littlejohn-Reuland Corp., Los Angeles, Calif.

Registration & Information Com-

mittee—Lloyd J. Mokler, Zamboni Brothers, Paramount, Calif.

Exhibits Committee—Earl F. Sweinhart, Sweinhart Electric Co., Los Angeles.

Finance Committtee—William C. Hill, Hill Electric Co., Los Angeles.

Women's Committee—Mrs. William M. Hogue (Larsen-Hogue Electric Co., Los Angeles) and Mrs. Earle F. Sweinhart (Sweinhart Electric Co., Los Angeles), co-chairwomen.

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New members in NISA are Bakersfield Electric Motor Repair, Bakersfield, Calif.; Link's Electric Motor Service, Ocala, Fla.; Dressel Electrical Co., Highland, Ill.; Creston Electric Motor Service, Creston, Iowa; Hub Armature Works, Lafayette, La.; Fixall Electric Motor Service, Grand Rapids, Mich.; Jones Electric Co., Muskegon, Mich.; Page Electric Co., Dunn, N. C.; Keith's Electric Motor Service, Eugene, Ore.; Barsh Electric Service, Aiken, S. C.; and Atlantic Electric Co., Santurce, Puerto Rico.

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Quaker City Chapter held its first meeting of the 1954-55 year at Beck's-on-the-Boulevard in Philadelphia on September 8. Newly elected officers presiding at their first meeting were: president, Milton H. Eisenhardt, who operates a business in Camden, N. J., under his own name; vice-president, William M. Hendrickson, W. M. Hendrickson & Co., Philadelphia; secretary, Frank A. Schaef, Electric Maintenance Equipment, Philadelphia; treasurer, C. R. Durand, H. N. Crowder Jr. Co., Allentown, Pa. Com-

IAEI OFFICERS of Westchester Chapter (New York) attending the 30th annual Eastern Section meeting at Atlantic City were Wallace E. Breitman, secretary, and Horace S. Odell, chairman, both with Consolidated Edison Co. of N. Y., at White Plains and Mt. Vernon, respectively.

RHODE ISLAND INSPECTORS representing Providence and Pawtucket, respectively, at IAEI's annual meeting of the Eastern Section were: James F. Burns, Jr., secretary of Roger Williams Chapter, and Wm. E. O'Neill, chairman of Board of Examiners for electricians for Rhode Island. Mr. O'Neill was first president of Roger Williams Chapter, served in this post for three years, and was followed by Mr. Burns as president.

mittee chairmen are: program committee, Ralph Kufen and Joseph Wagner, co-chairmen; membership committee, Samuel Augustine; publicity committee, Arthur Fowler; research committee, Joseph Previty.

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New England Chapter met September 16 at its usual meeting place, the Hotel Bradford in Boston. Following a business session, the meeting was turned over to Milton Volcker who entertained the group with a travelogue and color slides.

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Great Lakes Chapter held its September 11 meeting at the Whitemore Lake cottage of Charles J. Cannon, Nimmo Electric Co., Detroit.

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Niagara chapter met September 25 at the summer home of Barton Wardell (Wardell-Thurston Electric Co., Buffalo, N. Y.) on the St. Lawrence River near Clayton, N. Y.

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West Okaboji Lake, Iowa, was the scene of a joint meeting of the North Central and Midwestern Chapters held on September 17-18. In addition to three speakers, the program included a round table shop discussion conducted by North Central president Warren Mielke, Mielke Electric Works, Duluth, Minn., and Midwestern chairman, Robert H. Longmore, Omaha Electric Works, Omaha, Neb.

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The monthly meeting of the Central District Chapter was held on September 14 in Chicago's Tower Club. In addition to dinner, the program in-

cluded a panel discussion on "Technical and Shop Problems" and "Sales and Business Administration."

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New officers of the Northwest Central Ohio Chapter are: president, Andrew C. Benner, Modern Electric Service, Inc., Columbus; vice-president, Fred Wilkin, American Electric Works, Columbus; secretary, Wayne Pierson, Marion Electric Motor Service, Inc., Marion; treasurer, Elmer Girkins, Girkins Electric Co., Toledo; and assistant secretary, C. K. Glass, Glass Electric Motor Service, Springfield. The chapter held a luncheon meeting September 18.

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Longley Electric Co. Ltd., Vancouver, B. C., has moved to 45 E. Fourth Avenue and its new telephone number is Fairmont 6685.

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Joe Previty, vice-president of NISA, was a guest speaker at September meeting of New York Metropolitan chapter. Joe spoke on a very important problem of pricing motor repairs. Over 40 people who attended the meeting enjoyed this talk which was followed by a lively discussion.

From Walter J. Prise, Queens Electric Motors, Inc., Jamaica, L. I., N. Y.

DATES AHEAD

National Electrical Manufacturers Assn.—Haddon Hall Hotel, Atlantic City, N. J., November 8-11.

National Farm Electrification Conference—Van Curler Hotel, Schenectady, N. Y., November 18-19.

Plant Maintenance & Engineering Show—International Amphitheatre, Chicago, Ill., January 24-27.

International Heating and Ventilating Exposition — Commercial Museum and Convention Hall, Philadelphia, Pa., January 24-28.

American Institute of Electrical Engineers—Winter general meeting, Hotel Statler, New York, N. Y., January 31-February 4.

National Rural Electric Cooperative Assn.—Annual meeting, Atlantic City, N. J., February 14-17.

National Electrical Manufacturers Assn.—Edgewater Beach Hotel, Chicago, Ill., March 13-18.

Chicago Electrical Industry Show—Third biennial exhibit sponsored by the Electric Association of Chicago in cooperation with the Electrical Maintenance Engineers of Chicago, Conrad Hilton Hotel, Chicago, Ill., May 10-12.

National Fire Protection Assn.—59th annual convention, Netherland Plaza Hotel, Cincinnati, Ohio, May 16-20.

National Industrial Service Assn., Inc.—Annual convention, Hotel Statler, Los Angeles, Calif., June 5-9.

Illuminating Engineering Society—National Technical Conference, Statler Hotel,, Cleveland, Ohio, September 12-16.

Among the Manufacturers

Headquarters Announcements

Sunbeam Lighting Co., Los Angeles, Calif.—Daniel Rashall, national sales coordinator.

Beaver Pipe Tools, Inc., Warren, Ohio—Russell Herig, field sales mgr.

Youngstown Metal Products Co., Youngstown, Ohio—Henry A. Holberson, vice president and general manager.

Insul-8-Corporation, Burlingame, Calif.—C. J. Mayo, general sales manager.

Steber Mfg. Co. of Calif., Los Angeles, Calif.—John Kresich, sales manager; Paul Waterbury, special sales representative.

Sterling Electric Motors, Inc., Los Angeles, Calif.—John R. Howell, sales manager and director.

T. J. Cope, Inc., Philadelphia, Pa.—Frederick G. W. Ullberg, vice president and treasurer.

Minnesota Mining & Mfg. Co., Irvington Varnish & **Insulator Div.**, Irvington, N. J.—Frank J. McGuinn, sales manager.

Engineered Instruments, Inc., Hayward, Calif., has taken over the facilities and operations of D-V Welding Controls, Oakland, Calif.

Telecom, Inc., Kansas City, Mo.—W. P. Hercules, sales manager.

Brown Company, Berlin, N. H.—Laurence F. Whittemore, executive vice president.

Pittsburgh Reflector Co., Pittsburgh, Pa. has merged with the Holden Lighting Manufacturers Ltd., Ontario.

Markel Electric Products, Inc., Buffalo, N. Y.—Richard C. Piper, sales manager.

John A. Roebling's Sons Corp., Trenton, N. J.—Charles C. Shackford, product engineer for electrical wire division.

American Chain & Cable Co., Bridgeport, Conn., has purchased The Bristol Company, Waterbury, Conn.

General Electric Co. has opened a new plant for its welding equipment dept. in York, Pa. to replace the Fitchburg, Mass. plant.

Federal Pacific Electric Co., Newark, N. J. has acquired the Gardner Electric Mfg. Co., San Francisco, Calif.

Regional Appointments

NEW ENGLAND

Thomas & Betts Co.: Edward W. McCrane, sales representative for the Boston territory.

MIDDLE ATLANTIC

Pittsburgh Reflector Co.: J. A. White, Jr., field representative for northern and central New Jersey with offices in New York City.

BullDog Electric Products Co.: Robert L. Major, Pittsburgh, Pa. district sales manager.

Metalcraft Products Co., Inc.: James A. Jennings, sales representative for New York State excepting New York City.

Thomas & Betts Co.: Joseph Scholl, Baltimore, Md. and George Manahan, Albany, N. Y., sales representatives.

SOUTH ATLANTIC

Minneapolis-Honeywell Regulator Co.: H. E. Grossman, manager of Washington, D. C. branch.

Line Material Company: Robert E. Deal, apparatus engineer for the Carolinas, Georgia and Florida.

EAST CENTRAL

Ridge Tool Co.: Milo Sharp, Michigan and Indiana; Carl Petersen, Illinois, factory representatives.

Thomas Industries Inc., Moe Light Div.: Roger E. Keys, sales representative for Indiana and northeastern Ohio with offices in Indianapolis.

Minneapolis-Honeywell Regulator Co.: J. H. Nixon, manager of Grand Rapids, Michigan office.

WEST CENTRAL

Accurate Mfg. Co.: M. J. Cleary, sales representative, St. Louis, Mo.

Sylvania Electric Products Inc.: John J. Bahnak, district sales supervisor of the lighting division, Minnesota territory.

Ridge Tool Co.: Walter R. Miller, factory representative for North and South Dakota.

WEST

General Electric Co.: Harold C. Jenseth, plant manager of the San Francisco Distribution Assemblies Dept. plant.

General Controls Co.: Thaer Benjamin, manager of Salt Lake City, Utah branch office.

Accurate Mfg. Co.: M. J. Cleary, sales representative for northern California with offices in San Francisco.

Pittsburgh Reflector Co.: S. E. Gardner, field representative for southern California, working out of Los Angeles.

Sylvania Electric Products Inc.: Robert C. Harper, western regional sales manager for lighting; William L. Friend, Los Angeles district sales manager; Robert W. Thunen, San Francisco district sales manager.

Thomas & Betts Co.: E. L. Johnson, manager of the new sales office and warehouse in San Francisco.

A GOOD Habit

The Where-To-Buy Section of Electrical Construction and Maintenance supplements other advertising in this issue with these additional announcements of products and materials of special interest and application in the field of electrical construction, maintenance and repair work. Make a habit of checking this page each issue —a *good* habit!

SELENIUM RECTIFIER OPERATION

[FROM PAGE 100]

ac input of 208/230 volts, 60 cycles; dc output of 230 volts or 250 volts; 7½ kw to 100 kw. This is the unit most often used, and it is the cheapest.

2. Fan-cooled, 2-winding (or isolated winding) transformer type; ac input of 208/230 volts or 416/460 volts, 60 cycles; dc output of 230 volts or 250 volts. In same kw ratings as the previous type, this unit is used on 440-volt, 3-phase circuits. It is appreciably more expensive than the first type.

3. Normal convection cooled, autotransformer type; ac input of 208/230 volts, 60 cycles; dc output of 230 volts or 250 volts; ½ kw to 100 kw. In price, this type of unit falls between the two previous types. The unit has no fan or other moving parts. Only a pilot light will indicate when the unit is on. Occasionally when very large transformers are involved a hum can be heard. Quiet operation suits such a unit to applications where noise would be a disturbing factor.

4. Normal convection cooled, 2-winding transformer type; ac input of 208/230 or 416/460 volts, 60 cycles; dc output of 230 volts or 250 volts. This type has no moving parts and can be used on 440-volt lines.

Rectifiers for electroplating and electrochemical processing can be divided into three classes:

1. The most economical type is the fixed or basic voltage unit. It has one output voltage—not variable.

2. For larger units only, there is a rectifier type which permits partial control of voltage output—for instance, 6 to 12 volts or 3 to 6 volts.

3. A third type provides variable voltage over a full range—0 to 6, 0 to 9, etc.

Plating and anodizing rectifiers can be made with any input phase, cycle and voltages, with outputs from 25 to 25,000 amperes at constant or variable voltage. Typical specs are as follows:

1. Input: 1-phase or 3-phase 110,-220, 480 or 550 volts, 50 or 60 cycles. Output: fixed or variable, any dc voltage up to 60 volts, up to 300 amperes.

2. Input: 3-phase 208, 220, 440 or 550 volts, 25 or 60 cycles. Output: 0 to 24 volts dc, variable voltage, 2000 amperes.

Selenium rectifier assemblies are also made for 3-phase, 2300-volt input and for 3-phase, 208, 220, 440 or 550-volt input.

Advertising In This Issue

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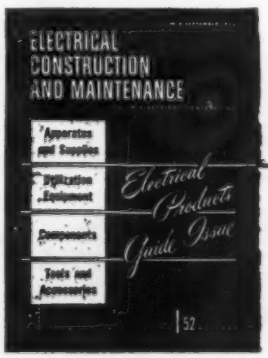
SEARCHLIGHT SECTION
(Classified Advertising)
H. E. Hilty, Mgr.



• These manufacturers advertised their products in the ELECTRICAL PRODUCTS GUIDE

For more complete information, and application data on their lines, refer to the Index of Advertisers in the ELECTRICAL PRODUCTS GUIDE . . . the 13th issue of ELECTRICAL CONSTRUCTION AND MAINTENANCE.

which of these feed-in duct features *rate highest with you?*

architects

rate these SQUARE D features particularly high:

lowest known voltage drop . . . maximum efficiency, minimum power loss

smallest cross-sectional area . . . conserves valuable installation space

contractors

give these features top billing:

reduced installation time . . . simplified components, factory prefabrication

new joint design (*lower right*) . . . all joint ends identical, connection bolts face outward

interchangeable standard fittings . . . permit horizontal or vertical riser applications

users

vote these SQUARE D features tops:

low cost installation and maintenance . . . most accessible connections

totally enclosed . . . permanent safety construction, excludes dust

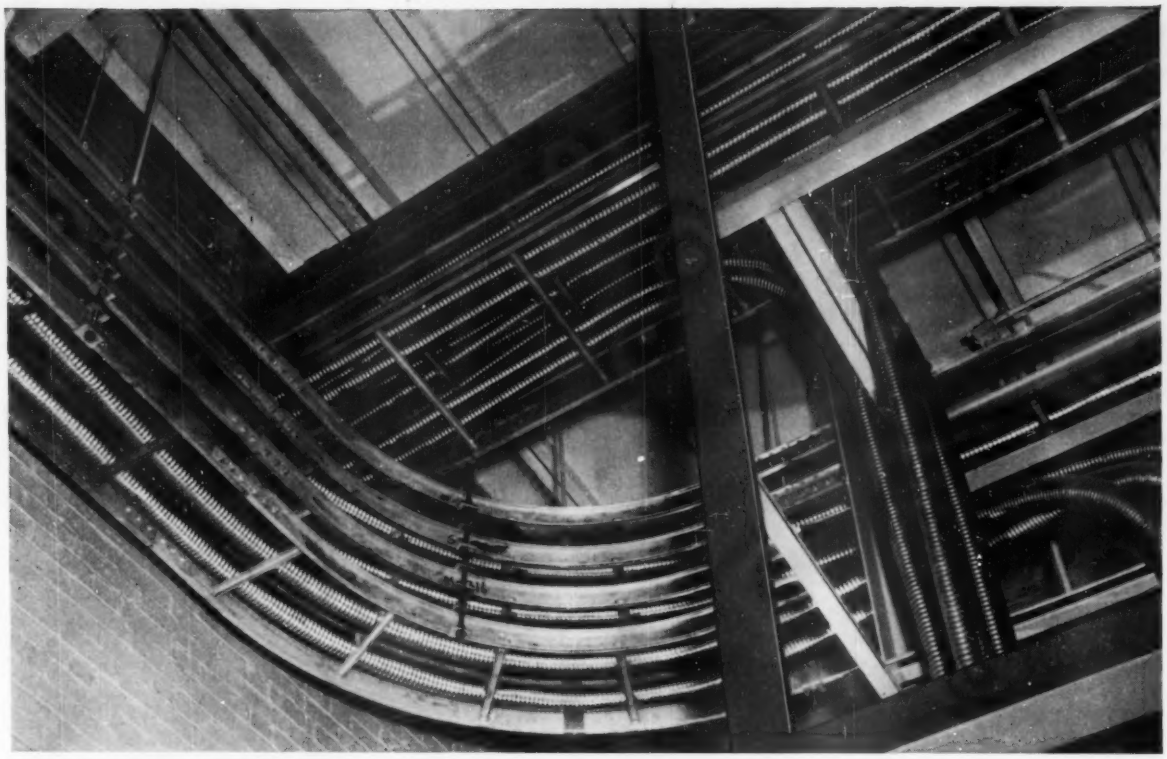
completely reuseable . . . rearrangement with the same components

EXCLUSIVE JOINT DESIGN

SQUARE D's exclusive joint design saves installation time and reduces maintenance cost. Joint ends are identical—unnecessary to select mating ends before positioning or hanging duct sections. Outward-facing, pre-installed bolts permit rapid assembly and easy maintenance.

ASK YOUR ELECTRICAL DISTRIBUTOR FOR SQUARE D PRODUCTS

SQUARE D COMPANY

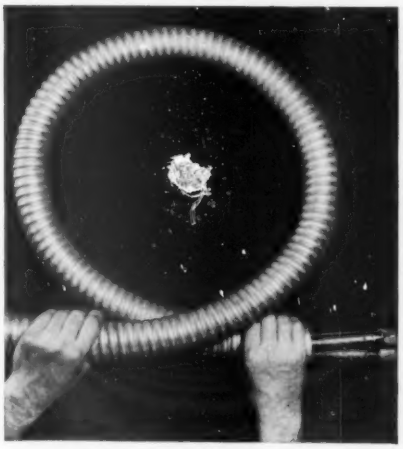


HOW TO SIMPLIFY FEEDER INSTALLATIONS

Solve the problem of installing cable in congested areas with a G-E V-c interlocked armor cable system

The easiest way to speed installation of primary and secondary feeder systems is to use lightweight, flexible G-E interlocked armor cable—indoors or outdoors. Easily-installed racks or troughs can be attached to existing structures. Corners and long unbroken runs are no problem because the cable is flexible, and is supplied in lengths to meet the requirements of the job. This cable system weighs only about a third as much as conventional cable and conduit installations, and the small over-all cross section of interlocked cable permits easy installation in crowded areas. Splicing is a simple mechanical job—easily done by electricians on the site.

For more information see your G-E Construction Materials distributor or write Section W142A-1118, Construction Materials Division, General Electric Company, Bridgeport 2, Connecticut.



The flexibility of G-E interlocked armor cable saves layout and installation time because the cable can be run easily around corners and over beams.

Progress Is Our Most Important Product

REWIRE AMERICA WITH GENERAL ELECTRIC WIRING SYSTEMS

GENERAL ELECTRIC